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PROGRAM STATEMENT

for the

PROPOSED PROTOTYPE OIL SHALE LEASING PROGRAM

U. S. Department of the Interior

June 1971

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INTRODUCTORY NOTE

IN HIS MESSAGE OF JUNE 4, PRESIDENT NIXON AFFIRMED THAT THE UNITED STATES, AFTER ENJOYING YEARS OF CHEAP AND PLENTIFUL ENERGY, IS NOW ENTERING A PERIOD OF INCREASING DEMAND FOR ENERGY AND GROWING PROBLEMS OF SUPPLY.[1/] AS ONE OF THE ELEMENTS OF THE PRESIDENT'S COMPREHENSIVE ENERGY PROGRAM TO HELP ASSURE FUTURE ENERGY SUPPLIES, INTERIOR SECRETARY MORTON RECENTLY OUTLINED TO THE SENATE OF THE UNITED STATES THE CONCEPT CONTAINED HEREIN FOR THE PROPOSED PROTOTYPE OIL SHALE LEASING PROGRAM.[2/]

THIS PROPOSAL OUTLINES A PLAN WHEREBY THE DEPARTMENT OF THE INTERIOR, OTHER FEDERAL AGENCIES, THE STATES, THE PUBLIC, AND INDUSTRY CAN ALL PARTICIPATE IN CREATING A PROGRAM WHICH MAY PERMIT THE ORDERLY DEVELOPMENT OF OUR VAST OIL SHALE RESOURCES WHILE AT THE SAME TIME ASSURING THE MINIMUM POSSIBLE IMPACT ON THE ENVIRONMENT. RELATED DOCUMENTS PREPARED IN CONNECTION WITH THIS PROPOSAL INCLUDE THE DEPARTMENT'S DRAFT ENVIRONMENTAL IMPACT STATEMENT[3/] REQUIRED BY SECTION 102(2)(C) OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, AND THREE SEPARATE REPORTS BY THE STATES OF COLORADO, UTAH, AND WYOMING, RESPECTIVELY.

DURING THE PAST 12 MONTHS THE DEPARTMENT HAS WORKED DILIGENTLY WITH THE ADVISORY COMMITTEES CREATED BY THE GOVERNORS OF COLORADO, UTAH, AND WYOMING TO OBTAIN A REGIONAL EVALUATION OF THE POTENTIAL ENVIRONMENTAL EFFECTS OF AN OIL SHALE PROGRAM.

[1/] President Nixon's Energy Message to the Nation, dated June 4, 1971.

[2/] Secretary Morton's Departmental Energy Statement to the Senate Committee on Interior and Insular Affairs, dated June 15, 1971.

[3/] This Draft Environmental Impact Statement is to be supplemented with additional data as detailed in this document.

THROUGH PROPER PLANNING, IT IS BELIEVED THAT THIS PROPOSED PROGRAM WOULD, ON BALANCE, BENEFIT THE NATION AS A WHOLE AS WELL AS THE OIL SHALE REGION ITSELF. THE PROTOTYPE PROGRAM HAS BEEN DESIGNED TO MINIMIZE UNFAVORABLE IMPACTS WHICH MAY BE SUSTAINED AS A RESULT OF INDUSTRIALIZATION AND ADDED POPULATION GROWTH FROM OIL SHALE DEVELOPMENT. AT THE SAME TIME, THE PROGRAM WOULD ESTABLISH WHETHER METHODS WHICH ARE NOW CONSIDERED ADEQUATE ARE EFFECTIVE IN REDUCING LOCALIZED DEGRADATION OF THE NATURAL ENVIRONMENT.

IT IS NECESSARY TO DEVELOP THE DATA ON SPECIFIC SITES WHICH ARE DESIRABLE FOR DEVELOPMENT. THE DEPARTMENT IS AUTHORIZING AN INFORMATIONAL CORE DRILLING PROGRAM TO DEVELOP THE SPECIFIC ENVIRONMENTAL AND RESOURCE DATA. AFTER THE DATA HAS BEEN OBTAINED AND EVALUATED, THE DRAFT ENVIRONMENTAL STATEMENT WILL BE SUPPLEMENTED AND THEN SUBMITTED FOR THE CONSIDERATION OF FEDERAL, STATE, AND LOCAL AGENCIES AND INTERESTED MEMBERS OF THE PUBLIC. PUBLIC HEARINGS WILL ALSO BE HELD. THEREAFTER, THE PROPOSED PROGRAM WILL BE CAREFULLY EVALUATED IN THE LIGHT OF ALL COMMENTS ON THE PROPOSAL WHICH HAVE BEEN RECEIVED BY THE DEPARTMENT DURING THE PERIOD PROVIDED FOR CONSIDERATION OF THE DRAFT ENVIRONMENTAL STATEMENT.

IF THE PROPOSED PROGRAM APPEARS FEASIBLE AT THAT TIME, A FINAL ENVIRONMENTAL STATEMENT WILL BE PREPARED. IF A FINAL ENVIRONMENTAL STATEMENT INCORPORATES CHANGES AFFECTING THIS PROGRAM STATEMENT, THE PROGRAM STATEMENT MAY BE SUPPLEMENTED AND THE PROGRAM MAY DIFFER IN SIGNIFICANT RESPECTS FROM THIS DOCUMENT. ONLY AFTER MEETING THE SPECIFIC CRITERIA INCLUDED IN THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, AND FULFILLING THE INTENT OF THE CONGRESS IN THAT LEGISLATION, WILL THE DEPARTMENT PROCEED WITH THE PROPOSED PROGRAM AND CONDUCT A LEASE SALE.

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I. Abstract

The availability of adequate fuel supplies to meet the Nation's various energy requirements is today a major concern. We have already been confronted with some energy supply limitations, and others are apparent for the years ahead. Out ability to provide energy from conventional domestic fuel sources (crude oil, natural gas, coal) has failed to keep pace with consumption, and at the same time, events in other parts of the world continue to emphasize the risks engendered when a highly industrialized Nation becomes dependent on foreign energy supplies that could be readily interrupted by military, political, or economic actions. These circumstances require the Federal Government to develop an energy policy consistent with national needs and provide the administrative and economic climate under which industry can provide adequate and clean domestic fuel supplies at the lowest practical cost consonant with environmental protection.

A major undeveloped energy resource available to the Nation is oil shale. The richest deposits, located in the Rocky Mountain area of the country, contain billions of barrels of oil. Development of this resource has not been undertaken in the past because accessible supplies of oil and gas have been available at a lower development cost. Our future energy needs are so large, however, that it is anticipated that the Nation's conventional domestic oil and gas supplies must be supplemented by liquid and gaseous fuels derived from oil shale, and tar sands within the next decade.

The long-term need to develop major new sources of oil and gas prompted the Department of the Interior to initiate, in 1969, development of the program described in this document for the prototype leasing of oil shale on public lands. The goal, planning sequence, and scope of the proposed program are as follows:

GOAL

The goal of the Department of the Interior's proposed prototype leasing program is to provide a new source of energy for the Nation by stimulating the timely development of commercial oil shale technology by private enterprise, and to do so in a manner that will assure the minimum possible impact on the present environment while providing for the future restoration of the immediate and surrounding area.

PLANNING SEQUENCE

More than a year of planning has been entailed in developing the program described in this document. Another year will be required to accomplish the resource and environmental evaluations to reduce systematically the number of available lease sites to a maximum of six. If the proposed program is implemented, leases for these sites would be offered for private industry development beginning in December 1972. Public review of the program as it evolves is an integral part of the planning sequence.

SCOPE

The primary oil-shale resources of Colorado, Utah, and Wyoming cover an 11 million acre area. The leases to be offered under this program can, by law, include no more than 5,120 acres for each lease, or a total of 30,720 acres for the combined six leases. The total area that could be affected under this proposed program is 0.5 percent of the lands estimated to be commercially valuable for oil shale in the three States.

This proposed program would affect only a small portion of the Nation's oil shale resource, and with existing techniques and controls, it is believed that the program could proceed without significant environmental risk. The results of prototype development would then provide the background information needed to formulate comprehensive resource utilization programs and regional land use plans. Additional leases of public oil shale lands would not be considered until the prototype development permitted under this program has been satisfactorily evaluated.

II. Introduction

Large areas of the United States are known to contain oil shale deposits, but those areas in Colorado, Utah, and Wyoming that contain the shale-rich sedimentary rocks of the Green River formation are of greatest promise for shale oil production in the immediate future (figure II-1). These oil shales occur beneath 25,000 square miles (16 million acres) of lands, of which about 17,000 square miles (11 million acres) are believed to contain oil shale of potential value for commercial development in the foreseeable future.

The known Green River formation deposits include high-grade shales[1] that contain about 600 billion barrels of oil.[2] Recovery of even a small fraction of this resource would represent a significant energy source adequate to supplement the Nation's oil supply for many decades, providing economic methods of shale oil production are developed.

It has long been known that petroleum liquids and gases can be obtained by heating oil shale in a closed vessel called a retort. Commercial production of shale oil abroad actually preceded by several decades the drilling of the first oil well in the United States. Shale oil industries have been established in many foreign countries in the past and exist today in mainland China and the U.S.S.R.

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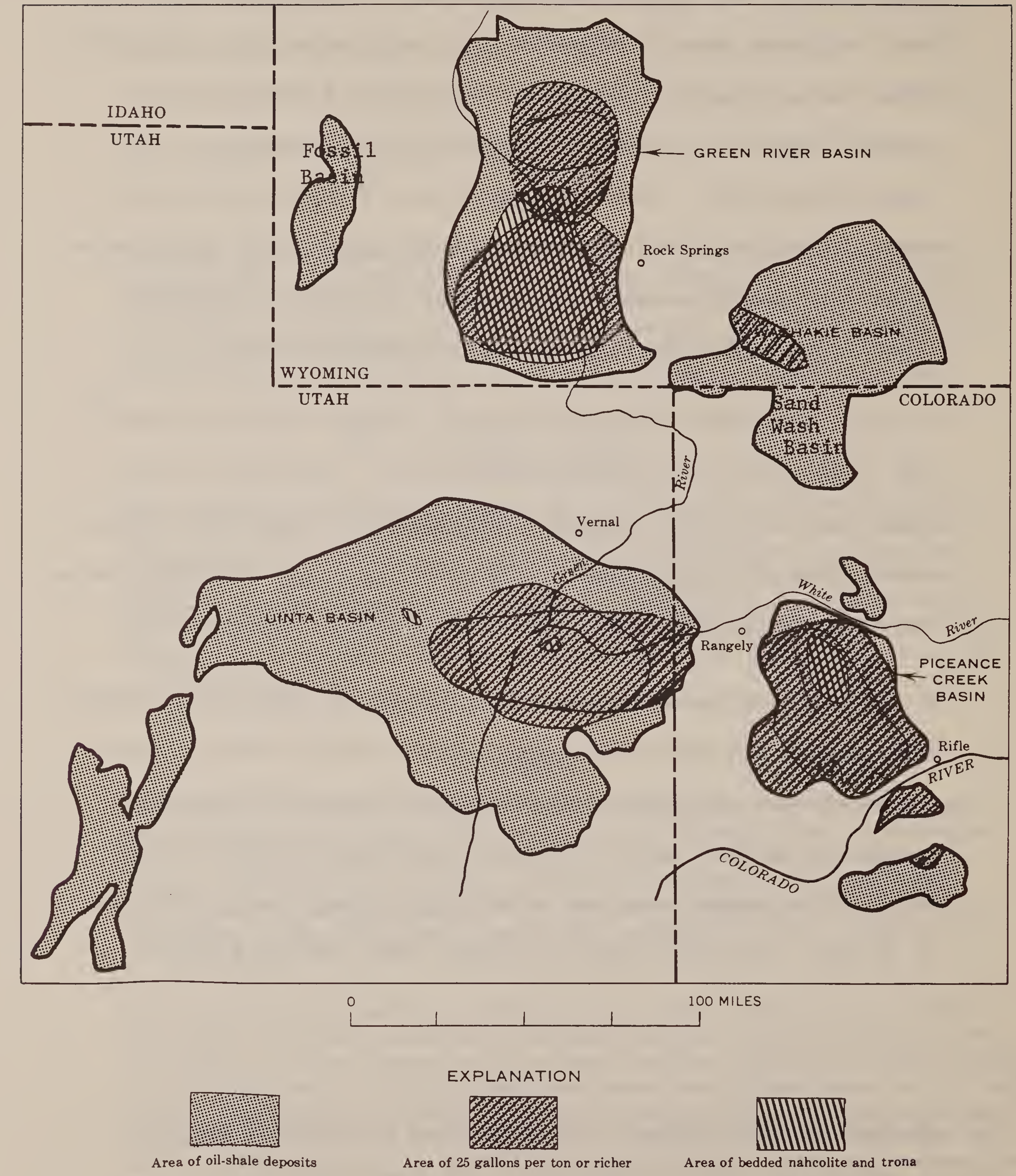
[1] At least 10 feet thick and averaging 25 or more gallons per ton.

[2] An additional 1,200 billion barrels are present in place in lower-grade shales, in sequences more than 10 feet thick that have an average yield of 15 to 20 gallons per ton.

Figure II-1. - Oil-shale Areas in Colorado, Wyoming, and Utah



(Being redrafted)

Although the Ute Indians used oil shale for campfires long before the first settlers arrived in Colorado, Utah, and Wyoming, interest in the commercial development of this extensive potential source of energy has fluctuated widely. Some oil from shale was produced prior to the 1859 discovery of natural petroleum, but industrial attention did not focus on oil shale until immediately prior to 1920, when there was some concern that domestic petroleum resources might become inadequate. Interest declined at that time as ample supplies of liquid petroleum were discovered and developed. Oil shale deposits were withdrawn from leasing pursuant to Executive Order No. 5327 of April 15, 1930, subject to certain later modifications,[1/] which authorized leasing of oil and gas and sodium in accordance with the terms of the modifications.

The Synthetic Liquid Fuels Act of April 5, 1944, as amended (30 USC §§ 321-325),[2/] made possible a large-scale oil shale research and demonstration effort by the Department of the Interior's Bureau of Mines during the period 1944-56. This effort was aimed at the creation of a new and more economic mining, retorting, and refining technology, and also sought to provide reliable information on the costs of commercial shale oil production.

The Department's accumulated knowledge of this resource and its expected potential was summarized in a comprehensive 1968 Interior study.[3/] Contemporary and future technologies, the economics associated

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1/ See Executive Orders No. 6016 of February 6, 1933 and No. 7038 of May 13, 1935; Public Land Order No. 4522 of September 23, 1968.

2/ Which has now expired.

3/ U. S. Department of the Interior, Prospects for Oil Shale Development, Colorado, Utah, and Wyoming, Washington, D.C., 1968, 134 pp.

with applying these technologies, and the public policy factors that could influence the rate of development of this resource were clearly delineated. Included also were estimates of the resource size and land ownership status. Efforts since the study's publication have been concentrated on: (1) an analysis of the probable environmental impact of oil shale development, (2) the formulation of a prototype leasing program within the framework of existing law, and (3) a program to determine ownership of the oil shale where title conflicts exist.

This document discusses the concept and planning sequence for a proposed prototype leasing program. The environmental aspects of oil shale development have been considered in another document. 1/

1/ U. S. Department of the Interior, Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program, Washington, D.C., June 1971.

III. Proposed Prototype Oil Shale Leasing Program

A. Program Concepts

Nearly 80 percent of the total oil shale resources of Colorado, Utah, and Wyoming are found on public lands. Oil shale is a leasable mineral, subject to the provisions of the mineral leasing laws.[1/] Under the authority and guidance provided by these laws, the responsibility for managing and leasing public oil shale lands is vested in the Secretary of the Interior.

No oil shale leases have been issued since 1925.[2/] A previous attempt to lease public lands (1968) was unsuccessful due to a number of interrelated problems stemming from the legal, environmental, and economic constraints of that leasing plan. Resolution of these problems will require effective coordination between the public and private sectors, since neither by itself has the full range of competence and/or responsibility to carry forth the proposed prototype program described in this document.

This proposed prototype program has been formulated, in part, to resolve past difficulties by making available for private development under carefully controlled conditions, a limited number of leases (six at most) of not more than 5,120 acres each. Specifically, the objectives of the program are to -

1. Provide a new source of energy to the Nation by stimulating the development of commercial oil shale technology by private industry;

[1/] See 30 U.S.C. §§ 241(a) and 352.

[2/] Should the program be implemented, Executive Order 5327 would be further modified to the extent necessary to allow the issuance of oil shale leases for the specific tracts selected.

2. Insure the environmental integrity of the affected areas, and concurrently, define, describe, and develop a full range of environmental safeguards and restoration techniques that can be reasonably be incorporated into the planning of a mature oil shale industry;
3. Permit an equitable return to all parties in the development of this public resource; and
4. Develop management expertise in the leasing and supervision of oil shale resource development in order to provide the basis for future administrative procedures.

The policy of the Congress embodied in the mineral leasing laws has been recently supplemented by enactment of the Mining and Minerals Policy Act of 1970 (84 Stat. 1876). That Act states that -

> . . . it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs, (3) mining, mineral, and metallurgical research, including the use and recycling of scrap to promote the wise and efficient use of our natural and reclaimable mineral resources, and (4) the study and development of methods for the disposal, control, and reclamation of mineral waste products, and the reclamation of mined land, so as to lessen any adverse impact of mineral extraction and processing upon the physical environment that may result from mining or mineral activities.

The Secretary of the Interior has been assigned the responsibility to carry out these policy directives in exercising his authority under the mineral leasing laws.

Oil shale development on public lands was studied by the Public Land Law Review Commission[1] which recently completed its charter to study and recommend to Congress legislation providing for, among other things, more effective administrative of public lands and mineral resources. Concerning oil shale development, that Commission recommended that -

> Some oil shale public lands should be made available now for experimental commercial development by private industry with the cooperation of the Federal Government in some aspects of the development.

Further, the Commission suggested that -

> . . . to be viable such a program should: (1) offer for lease, tracts sufficiently large to permit amortization of investments required for commercial development; (2) give weight to industry nominations relating to location and size of tracts, lease duration, and size of plant; (3) not bar the holder of a test lease from eligibility for leases subsequently issued under a general leasing program; (4) include experimental use of bonuses, royalties, and rentals; (5) provide fixed terms, conditions, and royalty payments for the term of the lease; and (6) not interfere with process patent rights of lessees acquired prior to issuance of the leases.2/

The proposed prototype program is consistent with the Congressional policy directives and the recommendations of the Public Land Law Review Commission described above. The proposed program would make available to private enterprise, for development under lease, a

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1/ Established by the Act of September 19, 1964, as amended, (43 U.S.C. §§ 1394-1400).

2/ Public Land Law Review Commission, One Third of the Nation's Land, Washington, D. C., 1970, p. 135.

limited amount of public oil shale resources. Such leases would be sold by competitive bonus bidding and would include assumption of certain royalty obligations to the United States. Additional oil shale leasing would not be considered until development under the proposed program had been satisfactorily evaluated.

B. Informational Core Drilling

At this time, specific sites have not been nominated for development, therefore, the detailed information necessary to fully assess the environmental and resource characteristics of such sites is not yet available. To develop the information needed by both Government and industry to evaluate selected lease sites, core drilling and lease nomination will be authorized.

Core drilling is the process of obtaining fresh subsurface samples of a rock formation using standard drilling equipment. The extracted oil shale and adjacent strata are then subjected to laboratory analysis to determine their chemical and physical properties. Various instruments are usually placed in the core hole created by drilling to obtain further information about the resource characteristics. Data from surveys of subsurface water quality and levels are among the most important information needed to assess the environmental problems associated with the potential development of a particular site.

A notice providing for submission of applications for core drilling permits is being published at this time in the Federal Register. The authorization for core drilling by private enterprise, as described below and in Appendix A, will provide for (1) public applications to drill for geologic and resource information, (2) approval of applications by the Department of the Interior, (3) supervision of core drilling by Interior field officials to insure compliance with regulations designed to avoid environmental damage, (4) incorporation in each permit of the performance requirements necessary to accomplish the above-mentioned objectives, and (5) sharing of all data with the Department. Applications must include, as required, a description of the proposed exploration program and the number and location of holes to be drilled.

These investigations and subsequent lease nominations will aid in focusing efforts to assess the indigenous plant, animal, and aquatic resources of that area and establish a basis for comparison to other present or potential uses of that particular area. These assessments will help develop a base of background information against which to measure any future development of the resource, and any resultant impact on the environment.

As detailed in subsequent sections of this document, public review of all pertinent environmental information will be conducted. A decision will be reached at that time to either implement, revise, or discontinue the proposed program.

C. Program Implementation

If the program is implemented and leases are accepted by private enterprise, operations would proceed under the terms of a lease specifically designed to achieve the stated program goal to stimulate ". . . the timely development of commercial oil shale technology by private enterprise, and to do so in a manner that will assure the minimum possible impact on the present environment while providing for the future restoration of the immediate and surrounding area." To achieve these goals we have provided an interlocking set of bonus, royalty, bonding, and performance provisions to be incorporated into the leasing provisions. Highlights of our current views of this leasing method are set forth below and detailed in Appendix B.

1. Bonus Bids - Sealed competitive bonus bids received from qualified applicants would determine who would be granted the right to develop the resource. Sealed bidding is an established, market-tested method for obtaining an equitable return for the resource when potential competition for the leases cannot be readily predetermined. This method is currently being used by the Department of the Interior in competitive leasing of the mineral resources on the Outer Continental Shelf. In the early years of an oil shale industry, the number of bidders may be limited by (1) lack of an economically proven technology, (2) large investment commitments that may exceed $200 million or more for each lease to be developed, and (3) energy market uncertainties.

The coring and evaluation program could show that valuable deposits of sodium or other leasable mineral are intermingled with oil shale on some tracts. In that event, it is anticipated that if the tract were selected for leasing, all the intermingled minerals would be included in a combined lease offering to permit efficient development of all those resources.

The initial bonus payment to acquire these first leases could create an undesirable economic burden on development because of: (1) other large investment requirements in the early years of a lease operation, and (2) the lack of an established technology with accurately predictable capital and operating costs. To reduce this economic burden, the bonus would be paid in five equal annual installments.

2. Term, Rental, and Royalty - The lease would extend for a term of 20 years, and so long thereafter as there is production in paying quantities. Readjustment of royalty and operating terms may be made at the end of each 20-year period. Annual rental of 50 cents per acre per year for the use of the land would be charged, as required by the Mineral Leasing Act of 1920, as amended, and would be creditable against royalties.

   Royalty is money due and payable to the lessor for the removal of the resource from the leased lands by the lessee. The royalty rate for this prototype program would be 12 cents for each ton of oil shale mined for processing that contains 30 gallons of shale oil per ton of material. Under the proposed lease, this rate would be adjusted, depending on the actual oil content of the mined material and the market value of the products.[1]

To spur development and to avoid long delays before development, a minimum royalty payment would be required. This payment is charged in lieu of actual royalty when production rates have not been achieved. Beginning in the sixth year, this minimum royalty would be \$1 per acre and would increase at the rate of \$1 per acre each year to and including the 10th year. During the 10th year, therefore, the minimum rate would be \$5 per acre.

Beginning in the 11th year, the minimum royalty would be transferred from an acreage to a production basis established by estimating recoverable reserves. For example, assuming a recoverable reserve of 2.1 billion tons of oil shale (1.5 billion barrels of shale oil) that averages 30 gallons of oil per ton, the calculated minimum production rate during the 11th year would be 3,500 tons per day of shale. Each year the calculated minimum production would increase a like amount to and including the 20th year (i.e. in the foregoing example, to 35,000 tons per day. During the 20th year and thereafter, unless readjusted, the minimum royalty would be determined on the basis of a calculated production rate of 35,000 tons per day).

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[1] The proposed royalty rate is comparable to other mined minerals under the Mineral Leasing Act of 1920, as amended.

3. Performance Requirements - Lease operations would require approved development plans and continued acceptable performance by the lessee. A preliminary plan for lease development by a prospective lessee would be incorporated in the terms of any lease offer submitted to the Department of the Interior. After lease issuance, but prior to actual operations, a detailed plan that includes all proposed development and production operations would have to be prepared, on or before the third anniversary of the lease. This plan would have to meet all of the established environmental criteria and be approved by the Department prior to the start of operations. It would include a detailed projected analysis of the amount and types of expected waste materials, the location and extent of the residue disposal areas, the types and amount of vegetation that will be used in land restoration, a time schedule for the restoration process, and justification that would assure this Department that the operator has designed his disposal-restoration system to protect the long-run productivity of the affected area. Annual progress reports would be required, and all physical facilities and records pertaining to the operations could be inspected by the Department, concurrently with continuous monitoring of the operation.

The operator would be expected to plan construction and other developmental activities, to the extent consistent with Federal law, in full coordination with the land use, transportation, and other plans of the county or other local public agency.

4. Bonding - A bond would be required as security to ensure that the approved development-restoration plan would be conducted in a manner designed to avoid degradation of the environment and that all other related lease terms would be met. The bond would be for not less than $500 per acre of the land that is estimated to be affected during the first 3-year period of operation, and would in no event, be less than a total amount of $2,000. A similar bond would be filed and maintained for each succeeding 3-year period of development. Provision could be made to credit extraordinary environmental costs, that may develop after the lease issuance, against the royalties otherwise due the Government. This provision has been considered only for this prototype program so that unanticipated environmental expenditures involved in the development of this resource would not be placed inequitably on the lessee.

D. Environmental Impact Studies

The continuous assessment of the environmental consequences of oil shale development is an integral part of the proposed program. This would begin before program implementation to establish a base against which to measure the actual environmental impact and would continue throughout the actual development phase.

1. Regional Environmental Review - Environmental studies were initiated in May 1970, when the Department of the Interior requested the Governors of Colorado, Utah, and Wyoming to form a Panel to study the impact upon the environment if oil shale leases were to be developed in their States and to determine the costs of appropriate environmental controls. Each of the Governors commissioned a study in accordance with the following suggested guidelines:

> Specifically, the environmental requirements of returning the residues from mining and refining to the earth for further use, and those costs involved will be developed between the Department and the States. - - -
>
> It is suggested that proposed methods of development for typical areas in each State be outlined and selected methods for mining and processing be studied. Each outline should include the current applicable regulations for each phase of the operation, or the proposed regulations to be adopted where the current standards have not been developed, in order that the resulting economic cost may be evaluated.
>
> Proposed methods of development should include:
>
> (1) underground mining, with underground disposal,
>
> (2) underground mining with surface disposal,
>
> (3) strip mining with backfill, and
>
> (4) in-situ operations.
>
> Particular care shall be taken to assure that the following provisions are included:
>
> (1) air quality standards are maintained,
>
> (2) surface and ground water quality is maintained,
>
> (3) restoration of the lands is commensurate with future land use plans,
>
> (4) wildlife habitat is protected and restored for future use, and

(5) scenic and aesthetic values are to be maintained.

The resulting studies should provide that future land use requirements will be in accordance with State and local plans for development.

Specific requirements as to soil compaction, drainage, revegetation, and community development plans should be included in each summary in order that a complete economic evaluation of the total environmental costs may be made by the Department and by prospective lessees.

The basis for preparing the Draft Environmental Impact Statement required under Section 102(2)(C) of the National Environmental Policy Act of 1969 was provided by Departmental and Interagency studies, and by the States of Colorado, Utah, and Wyoming. This detailed 7-month study of lease sites, typical of those that are expected to be nominated for development under the proposed program, involved more than 150 professionals with diverse backgrounds, including representatives from various Federal and State agencies, research foundations, universities, independent conservation groups, and industrial firms. These documents are available[1/] and contain extensive information on the expected environmental impact and controls that could be applied if oil shale operations were initiated.

Under the provisions of this proposed program, detailed environmental studies will be conducted of the actual sites nominated for leasing. No lease shall be offered if the rigorous

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[1/] Copies of the Department of the Interior's Draft Environmental Impact Statement and additional copies of this Proposed Program Statement for the Prototype Oil Shale Leasing Program are available through the U. S. Geological Survey, Map Information Office, Room 1038, General Services Building, Washington, D.C. 20242, at $2.00 per copy. Individual reports (without appendices) prepared by the States of Colorado, Utah, Wyoming may also be purchased through the same office at $2.00 per copy.

environmental criteria established for this prototype program cannot be adequately satisfied.

2. Detailed Environmental Studies

a. Prior to Program Commitment - Informational core drilling operations and lease nomination will identify the areas of greatest commercial interest and aid in directing efforts aimed at assessing environmental impacts.

Among the factors to be considered are existing and anticipated land uses, the indigenous plant and animal life, and aquatic resources of the proposed site and surrounding area. The site location relative to known historical, archeological, and scenic attractions will also be assessed.

The type of mining-waste disposal system(s) most likely to be used if the proposed site were developed will then be evaluated in relation to the actual characteristics of the area. Where there is a distinct probability that operations would have an unacceptable impact on existing resources, or where there are apparent unacceptable risks, nominated sites will be eliminated from subsequent considerations in accordance with the criteria for lease rejection which have been clearly enumerated.1/

These detailed environmental studies will establish prevailing conditions against which to measure actual environmental impact. The studies will be conducted by the Department of the Interior

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1/ U. S. Department of the Interior, Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program, Washington, D. C., 1971, Chapter IV.

and will include consultation with the Governors' Panels of the States of Colorado, Utah, and Wyoming.

Environmental information developed for each site will be published as a supplement to the 1971 Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program and be subjected to public review.

b. Following Leasing - A primary objective of this prototype program would be to compare the actual environmental impact with the projected impact. Air and water quality would be monitored by the site operator and assessments of the environmental consequences would be made by both the operator and Government representatives. The impact on other resources including agriculture, fish, wildlife, recreation, and general aesthetics would also be assessed. Actual plant-site development would be compared with the plans of the local governments, in order to assure effective coordination.

Operations must meet the specified standards. Failure to comply in a reasonable time could result in cancellation of the lease. Where operations cause unforeseen environmental effects, operating procedures will be changed consistent with the terms of the lease to control such effects to the maximum extent possible. Additional costs incurred by the operator in making such changes could be credited against royalties due the Government as described in Appendix B.

E. Planning Sequence

The Departmental activities related to the oil shale prototype leasing program have required more than a year of extensive planning to obtain the data included in the Department's Draft Environmental Impact Statement. An additional year will be required to accomplish the resource and environmental evaluation for specific lease sites that may be nominated. Public hearings will be held prior to reaching a final decision concerning program implementation.

1. Past Planning Activities

October 1969 - An oil shale study was initiated by the Assistant Secretary--Mineral Resources and the Assistant Secretary--Public Land Management.

October-December 1969 - Review of Mineral Leasing Act and previous Departmental efforts to lease oil shale resources in public lands.

December 1969 - Oil Shale Task Force formally established to draft a prototype oil shale leasing program proposal and to implement a program if approved.

May 1970 - Proposed program presented to the Secretary of the Interior, who directed that additional environmental analyses be made prior to program implementation.

May-June 1970 - The Governors of Colorado, Wyoming, and Utah formed State committees to study the environmental impact and related costs for appropriate environmental controls.

June 1970 - Public meetings conducted in each State on the proposed prototype leasing program.

August 1970 - Officials of private, State, and Federal agencies conducted a week-long field survey of sites typical of those that may be developed.

August to December 1970 - In the three-state area, the Deputy Oil Shale Coordinator participated in 14 public oil shale meetings with environmental groups and other public bodies.

February 1971 - State Governments formally transmitted to the Secretary of the Interior an evaluation of the environmental impact of oil shale development as related to the resources in their States.

March-June 1971 - Interior's Draft Environmental Impact Statement prepared in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969.

June 1971 - Draft Environmental Impact Statement for a Prototype Oil Shale Leasing Program submitted for public review.

2. Future Planning Activities

June 1971 - Authorize core drilling on public oil shale lands in Colorado, Utah, and Wyoming.

> Details of the special land use core drilling permits to be used are contained in Appendix A of this document. Considerable data now exist concerning the overall oil shale region, but detailed data for specific sites are limited. This information is needed to delineate the extent of the beds and to define the physical, chemical, and geologic conditions, and can only be obtained by drilling into the formation and obtaining representative samples for subsequent analysis.
>
> Core drilling will serve three distinct purposes. First, it will provide private industry with the data needed to evaluate the resource potential of various lands. Second, it will provide the Government with the information needed to assess the probable environmental impact of oil shale development at that particular site. Third, the lands nominated for leasing by the private sector will identify those sites of greatest economic interest.
>
> Special environmental stipulations will be incorporated into each permit to ensure that the environment is protected and restored to a condition compatible with future use.

Fall 1971 - Open Lease Nomination period.

Fall 1971 - The Solicitor of the Department of the Interior will give a legal opinion as to the propriety of leasing oil shale lands, the title to which is uncertain, in the circumstances described below.

Portions of the desirable oil shale lands are within unpatented mining claims, and, consequently, a conflict exists concerning title to these lands. In many cases, several years of court actions are expected before their status is clearly established. Special provisions are under consideration for the leasing of such lands, if nominated, which would provide for the retention in an escrow account of the bonus, rentals, and royalties received by the Government, pending final judicial determination of the ownership of the lands and oil shale deposits therein. Leasing in these circumstances would, of course, be dependent on the agreement of all interested parties.

Fall 1971 - Publish in the Federal Register as proposed rule making, lease terms and regulations for this proposed prototype program for public comment.

The early release of the Government's proposed lease terms (Appendix B) and regulations is particularly critical in oil shale since large amounts of capital must be committed to participate in the program, requiring long-range detailed planning by the private sector. Timely presentations of this program will help foster the positive climate needed to stimulate oil shale development.

Winter 1971-Spring 1972 - Environmental impact studies of the nominated sites.

This review will be conducted by the Department of the Interior after consultation with the Governors' Panels of the States of Colorado, Utah, and Wyoming. Its purpose is to eliminate from subsequent consideration those sites which appear to have an unacceptable impact on existing resources and those which appear to present unacceptable environmental risks.

January 1972 - Close the period to receive lease nominations.

Spring 1972 - Publish detailed environmental information concerning the potential sites for leasing and, concurrently, permit continued appraisal of the potential sites through additional core drilling. Hold public hearings on the Draft Environmental Impact Statement and supplement.

This is an important phase in the proposed prototype leasing program for it offers for public review all of the available information pertaining to the environmental impact.

3. Program Implementation

All activities described in this section must await a decision to either implement, revise, or reject the proposed prototype leasing program. This section, therefore, will only apply if the proposed program is approved.

Summer 1972 - Publish Final Environmental Impact Statement.

Fall 1972 - Establish the environmental standards that will be incorporated into each lease to be offered and close the evaluation core drilling period.

About 5 months has been allowed for both the Government and industry to evaluate the sites to be offered and to clarify any of the published requirements regarding the terms of operations under the leases.

December 1972 - Begin lease sales - one tract every 2 weeks for a total of six tracts.

Lease offerings will include two tracts from each of the three States, if nominations are received and the lands are evaluated by industry.

Sales of one lease every 2 weeks, starting with the tract receiving the greatest competitive interest, will be conducted. Such a procedure is appropriate, owing to the requirement of the law[1/] which restricts to one the number of leases which may be held by one person. After a specific tract has been leased, the position of the remaining tracts and bidders will change. Time will be required for each remaining bidder to review his position regarding the remaining tracts.

Early 1973 - Issue lease(s) upon receipt of acceptable offer(s) which incorporate preliminary plan of development.

1973 on - Monitor operations and require changes as needed to mitigate adverse environmental effects.

F. Program administration

1. Oil Shale Task Force. A formal Oil Shale Task Force has been established to develop a close liaison between all disciplines that have bearing on oil shale development. Specifically, the responsibilities of this Task Force are to --

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[1/] See 30 U. S. C. § 241 (a).

(1) Develop a model administrative system for oil shale development on Federal lands and undertake environmental planning for local and regional land use development to the maximum degree possible.

(2) Actively develop a broad-based, interdisciplinary participation in the planning and implementation phases of this program by coordination of activities with Panels established by the Governors of each of three involved States, with other Federal and State agencies, and with the general public.

(3) Provide the means whereby optimum development of oil shale resources can be achieved by private industry.

(4) Develop lease terms and a monitoring system that will assure that these environmental and resource objectives could be achieved.

This Oil Shale Task Force is headed by an Oil Shale Coordinator (Washington, D. C.) and a Deputy Oil Shale Coordinator (Denver, Colorado), jointly appointed by the Assistant Secretary--Mineral Resources and the Assistant Secretary--Public Land Management, to whom the Coordinators are responsible. Advisors to the Oil Shale Task Force include representatives from the Office of the Assistant Secretaries for Programs, Mineral Resources, Public Land Management, Fish and Wildlife and Parks, Water and Power Resources, and the Solicitor's Office. In addition, 12 Bureaus and Offices within this Department have assigned 28 professionals to participate as Task Force Members.

Approximately 60 representatives from 14 different agencies[1/] other than Interior have also been briefed on the goals, scope, and status of the program as it has evolved. These representatives have

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[1/] Atomic Energy Commission, Council on Environmental Quality, Departments of Agriculture, Commerce, Defense, Housing and Urban Development, Labor, State, Transportation, and Treasury, Environmental Protection Agency, Federal Power Commission, Office of Management and Budget, and Office of Science and Technology.

been afforded the opportunity for informal review of the Department's Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program prior to submittal to their Departments for formal comment.

The Governors' Oil Shale Advisory Panels have shown themselves to be a highly effective means of enlisting the cooperation of State and local governments, private interest groups, and industry in this major Federal program. The State studies have included over 100 people of various backgrounds in the effort to delineate the environmental impact and costs of oil shale development.

The administrative approach outlined above has led to the establishment of an effective system of communication and local cooperation, and has provided the means for expediting responses to questions concerning the program. The Oil Shale Task Force will be a continuing body working cooperatively with the state oil shale committees should the proposed program be implemented.

IV. Interior Actions Related to the Proposed Prototype Program

Many activities associated with the effective management of the Nation's oil shale resources must be carried on concurrently with the proposed prototype leasing program. The actions that will be conducted within this Department include the following:

A. Ownership of Lands

Title to Federal lands in the oil shale area has been clouded for years by virtue of the existence of unpatented mining claims, including oil shale placer claims. Adjudication of the validity of these mining claims is needed as rapidly as possible to clear title, whether the claims are rejected or patents are issued.

B. Legislative Requirements

Consideration will be given to proposing appropriate legislation to update the oil shale section of the Mineral Leasing Act, with due regard to the recommendations of the Public Land Law Review Commission.[1/] Among the provisions which would be studied are:

1. Limitation on the number and size of lease holdings.

   The present provisions of the Mineral Leasing Act may fail to recognize the land requirements of oil shale development on the scale of operations that will be required to fully develop an industry based on improving technology.

2. Unit operations involving fragmented government tracts.

   The potential oil shale development of fragmented public acreage adjacent to private holdings may not be realized unless plans and actions are undertaken to provide for their use at this early stage of development of the industry. The authority to combine or unitize public with private holdings would offer additional commercial sized tracts for development. The Mineral Leasing Act does not adequately provide for this potential.

1/ Public Land Law Review Commission, One Third of the Nation's Land, Washington, D.C., 1970, 342 p.

3. Land exchanges to provide for blocking up of workable tracts of oil shale both for public and private lands and to provide for appurtenant facilities.

   Another approach which could help to solve the problem of fragmented acreage would be the establishment of a land exchange policy. In the past, the Department has considered this problem and concluded that land exchanges could be consummated. Needs for public land use or exchanges for plant location, waste disposal, and other appurtenant facilities are among the many reasons that this subject merits further review and clarifications.

C. Research

To complement the requirements of oil shale development, a specifically directed program of research would be desirable in a number of interrelated fields. This Department would direct available funds to conduct such research. It would also encourage the research outlined below to be undertaken by industry, other Federal or State agencies, and attempt to coordinate these programs to obtain the maximum benefits.

1. Waste Management Techniques. Revegetation is initially needed for watershed protection. It has been experimentally demonstrated that vegetation with adequate fertilization, watering and reseeding can be grown on processed oil shale. For example, Kentucky blue grass, western wheat and crested wheat have been successfully grown, and initial findings indicate that, once established, some of these species may be permanently sustained without further maintenance. Further investigations would be needed to develop and improve methods for stabilizing and accelerating vegetative growth.

A longer range re-vegetation goal would be the re-establishment of the natural plant community, or suitable replacement, to serve as wildlife food and cover. Native sage, Englemann Spruce and juniper have been successfully transplanted to oil shale areas. However, a significant body of research experience indicates that re-establishment of the fuller range of native browse and cover species, such as mountain mahogany, shadbush and bitterbrush, may bedifficult and time-consuming. Additional investigations are needed in this area.

Particular emphasis should be placed on developing additional techniques to create nutrient and top soil structure suitable for re-establishment of permanent vegetations. Important variables requiring study include particle size of spent shale, degree of fertilization, addition of top soil or overburden, and extent of moisture control through mulching or irrigation. As large scale operations evolve and as retorting and waste production become better defined, cooperative efforts may be desirable to relate and adapt the information to existing or potential oil shale operations.

Problems associated with surface storage of the solid wastes derived from oil shale operations can be minimized by storing such wastes in eroded canyons, in the minded-out voids produced underground, or in the pits created by surface mining. Much experience directly and indirectly applicable to oil shale operations is available from other mineral-processing disposal operations. However, specific investigations may be desirable with respect to such factors as support characteristics of various spent shales of different particle size and degree of compaction, extent to which waters used in underground spent shale disposal may influence underground water sources, methods of water recovery from spent shale slurries, degree of natural cementation of oil shale wastes, and means of augmenting or inducing cementation with additives.

In situ retorting poses minimal problems regarding disruption of the land surface, since no spent shales are generated. Therefore, restoration of the surface would not be expected to be troublesome; nevertheless, investigation of surface restoration needs of in situ retorting would be warranted. There should also be further investigation of methods to impound, dispose, and utilize produced process waters, and methods to determine the degree, if any, of contamination of underground aquifers.

2. Leaching Characteristics of Retorted Shales. Consideration should be given to extending research to such subjects as the susceptibility of leaching by water percolation of spent shales produced by different processes performing under various operating conditions. It is particularly important to define leaching potential as a function of particle size, concentration of residual carbon moisture content, degree of compaction, and cementation. This work would have to be conducted concurrently with commercial-scale operation to insure optimum design and functioning of leaching control systems for each specific plant.

Information related to subsurface leaching problems associated with in situ operations is sparse at present. The Bureau of Mines is currently conducting process water studies in conjunction with its experimental in situ retoring program. Consideration for augmenting this work with concurrent hydrologic studies is desirable to define possible problems as well as the extent of ground water contamination.

3. Hydrologic Studies. Data available on the occurrence and movement of regional underground waters are limited. The exploration phase of the program should provide more hydrologic data in the areas nominated for leasing. However, consideration for additional studies of the regional hydrology within the oil shale area should be investigated, in order to further delineate the aquifer characteristics, connections between aquifers, direction and rate of water movement, heads in individual aquifers, chemical quality of the waters and its regional variations, points of water discharge, and relationships between ground water and surface water.

4. Retort Gas Properties. Although not expected to be a significant problem, potential air pollution associated with retort gases should be analyzed in more detail. Attention should be directed to the amount of sulfur oxides, nitrogen oxides, hydrocarbons and particulates present in these gases, particularly in newer retorting processes, and the identification of potential pollutants that may have gone undetected up to this time. As retorting technology is further developed, frequent stack gas

monitoring should be conducted, since the type and concentration of pollutants may vary with changes in such variables as, for example, retorting temperature.

5. Wildlife Protection. One of the environmental impacts of shale development could be its effects on wildlife. Support for systematic research and field evaluation are desirable from both the private and public sectors, to improve the skills and materials needed to properly revegetate disturbed areas with native plants of high food or cover value specifically for wildlife, or equivalent substitutes.

   Off-site activities should receive primary consideration. Typical examples of the approaches that could be taken to minimize the impact on wildlife are selective clearing of pinion-juniper to stimulate the growth and vigor of key browse and cover species of vegetation, off-site seed bed preparation and seeding of key forage, application of fertilizers in select areas, the possible enhancement of the revegetation process through soil structure mixing of topsoil, subsoil, rocky overburden, and spent shale, redistribution of trees, shrubs, and brush from mining and plant sites to cover deficient areas, protection of existing water sources for wildlife (for example, natural springs), and prohibition of livestock grazing in critical wildlife areas.

Wildlife research would be desirable upon the initiation of oil shale operations, ancillary urban development, and resulting population pressures. Mule deer, antelope, and other species should be studied with respect to changes in life history patterns, locations, and abundance during both construction and operations of the facilities.

V. Regional Economic Aspects of Oil Shale Development

To this point, this Program Statement has detailed the planning activities associated with the proposed leasing program. This Chapter and the one following discuss the potential longer term effects of oil shale development on the region that will support this industry and on the Nation who will consume its products.

This Chapter shows that oil shale development will generate within the region both permanent and temporary employment. Extensive flows of capital into and out of the region will also occur as the equipment and services needed to sustain the operations are utilized. A number of assumptions must be made to study this potential economic impact. Although the assumptions could be varied, the cumulative effect of development on both private and public lands presented in this review is based upon the most optimistic projections, in order to show the magnitude of the maximum impact that may be expected, and to provide an indication of the urban planning needed to facilitate this new industry.[1/] It will require 8 to 10 years or more to achieve a viable commercial industry.

A. Sequence of Development

The rate at which oil shale may be developed provides the framework within which subsequent calculations may be made, considering both the stage of technology and the size of the capital investments that will probably be required. Six installations are assumed to be operated on both private and public lands in the period 1973 to 1983, as shown in table V-1. Following one another by one year, surface plants number 1 and 2 would each

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[1/] See also, Ryan, J. J. and Welles, J. G., Regional Economic Impact of a U. S. Oil Shale Industry, Denver Research Institute, University of Denver, July 1966.

Table V-1. Projected Individual Capacity and Cumulative Shale Oil Capacity at Six Sites

(Thousands of barrels per day)

Year	Plant capacity at site						Cumulative capacity 2/
	1	2	3	4	5	6	
1973 1/	--	--	--	--	--	--	0
1974 1/	10	--	--	--	--	--	10
1975 1/	50	10	--	--	--	--	60
1976 1/	50	50	--	--	--	--	100
1977 1/	50	50	50	--	--	--	150
1978	100	50	50	--	--	--	200
1979	100	150	50	--	--	--	300
1980	100	150	50	50	--	--	350
1981	100	150	50	50	150	--	500
1982	100	150	150	50	150	--	600
1983	100	150	150	50	150	300	900

1/ Production in these years would be sporadic at all sites, as individual plants are operated to examine mining and process variables, and are modified to improve efficiency. Rates of production shown are intended only to demonstrate the maximum regional, economic, social, and community impacts that could be anticipated.

2/ Although the prototype leasing program is expected to initiate development by providing a Federal leasing policy, total growth undoubtedly will be distributed between private, State, and Federal lands.

NOTES - Sites 1 and 5 - Underground Mines, with mine disposal
Site 2, 3, and 6 - Surface Mines, with backfill
Site 4 - In situ production

start with only 10,000 barrels per day capacity, allowing a year to prove out the retorting technology before a minimum expected commercial capacity of 50,000 barrels per day is reached. Each of these plants may then be expected to operate for about 3 full years before being further increased in capacity. Subsequent surface plants are estimated to be commercial sized plants from the start, the size being determined by the technology used and assumed improvements in that technology.

The cumulative capacity of 300,000 barrels per day by 1979 reflects the necessary construction and evaluation phase of this new technologic development. Second generation technology could be expected to be available by 1980, enabling the large increases in capacity from surface processing systems shown in table V-1. In-situ retorting may also be advanced to the point where the first commercial operation could be initiated. By 1983, cumulative capacity is estimated at 900,000 barrels per day from both private and public lands.

B. Employment and Population

Development of oil shale will create both temporary and permanent employment, a factor which must be considered in regional development plans.

1. Temporary - All temporary employment will be associated with the construction of the plants and urban communities. Temporary support employment would be required to provide services to these construction employees. These jobs would be temporary only in the sense that the job terminates with the completion of the construction. As long as the industry continues to develop, shifting of construction personnel should take place between the different plant sites. Thus,

as shown in table V-2, total construction employment would gradually increase from about 2,700 in 1973 to about 20,000 in 1982.

2. Permanent. All permanent employment would be associated with the daily operation of the plants and in providing supporting services. As shown in table V-2, permanent employment would increase continually during the active construction period. By 1980, permanent employment should be approximately equal to temporary employment at about 11,000 jobs.

3. Total Employment and Population. As shown in table V-3, the total employment associated with oil shale development should gradually increase to about 36,000 by 1982. Including the families of these new employees, the population of the region may grow by an additional 92,000 people over the 1973-82 period.

4. Current Employment and Population. In the seven counties which comprise the oil shale region, the population in 1970 was about 117,000, of which 44,000 were employed (table V-4). The creation of over 30,000 new jobs cannot be satisfied from the existing population, and therefore a migration into the region would result. Over a 10-year period, the total population of the area would thus almost double.

Table V-2. Oil Shale Construction and Operating Employment.

	Number of People						
Year	Temporary construction employment				Permanent operating employment		
	1/ Plant	5/ Urban	3/ 4/ Support	Total	1/ Plant	2/3/ Support	Total
1973	1,217	435	1,033	2,685	0	0	0
1974	3,819	1,475	3,354	8,720	540	416	956
1975	2,933	1,645	2,861	7,439	1,830	1,409	3,239
1976	2,933	1,645	2,861	7,439	2,580	1,987	4,567
1977	2,135	1,317	2,158	5,610	3,870	2,980	6,850
1978	5,985	801	4,241	11,027	4,214	3,245	7,459
1979	5,500	1,741	4,526	11,767	4,864	3,745	8,609
1980	3,850	2,809	4,162	10,821	6,374	4,908	11,282
1981	7,700	2,116	6,135	15,951	8,349	6,429	14,778
1982	10,010	2,366	7,735	20,111	8,999	6,929	15,928
1983	6,160	1,842	5,001	13,003	11,284	8,689	19,973

1/ Source: Bureau of Mines. The number of operating employees per unit of shale oil produced will decrease as the size of the plants increases.

2/ Based on employment multiplier of 0.77 times permanent plant employment, Source: Consulting Services Corporation, for the Public Land Law Review Commission, Study of Impact of Public Funds on Selected Regional Economics, April, 1969, p. 104.

3/ Assumes 1.37 employed people per new household.

4/ Based on employment multiplier of 0.63 times temporary plant plus urban employment; Source: Same as footnote 2, but modified to reflect the experience that 1/4 of all construction support workers will not bring their families into the region.

5/ Derived from value of labor for urban construction, see Table V-6, footnote 1.

Table V-3. Total Employment and Population Associated with Oil Shale Development.

Year	Number of People					
	Employment			Population 1/		
	Permanent operating	Temporary construction	Total	Permanent	Temporary	Total
1973	0	2,685	2,685	0	6,546	6,546
1974	956	8,720	9,676	2,581	21,263	23,844
1975	3,239	7,439	10,678	8,745	18,140	26,885
1976	4,567	7,439	12,006	12,331	18,140	30,471
1977	6,850	5,610	12,460	18,495	13,679	32,174
1978	7,459	11,027	18,486	20,139	26,890	47,029
1979	8,609	11,767	20,376	23,244	28,692	51,936
1980	11,282	10,821	22,103	30,461	26,386	56,847
1981	14,778	15,951	30,729	39,901	38,896	78,797
1982	15,928	20,111	36,039	43,006	49,040	92,046
1983	19,973	13,003	32,976	53,927	31,708	85,635

1/ Based on a family size of 3.7 persons; Source: Bureau of Census data for Colorado, Utah, and Wyoming.

Table V-4. Population and Labor Force of Counties Within the Oil Shale Region, 1970.

Thousands of People

	Population	Civilian work Force 1/	Employment 1/	Unemployment 1/
Colorado:				
Garfield	14.6	5.7	5.5	.2
Mesa	52.6	20.4	19.6	.8
Rio Blanco	4.8	2.5	2.4	.1
Utah:				
Duchesne	7.0	2.6	2.4	.2
Uintah	12.5	5.0	4.8	.2
Wyoming:				
Sweetwater	18.4	7.5	7.0	.5
Uinta	7.1	2.7	2.5	.2
Total	117.0	46.4	44.2	2.2

1/ Colorado figures are based on 1969 data.

C. Expenditure Flows

The oil shale industry should stimulate expenditures for both plant equipment and urban facilities. Significant payment of money to the employees (as salaries), and to Federal, State, and local governments (as taxes and other revenues) would also be produced.

1. Plant and Urban Construction. The cost of the oil shale plant depends upon both the technology used and the size of the expected output (table V-5). These data and the previously described development schedule (table V-1), were used to estimate annual plant equipment purchases from 1973 to 1983 (table V-6). Nearly $2.7 billion would probably be spent over this time period for the equipment needed to produce a 900,000-barrel-per-day shale oil output from both private and public leases.

   Urban construction would be required to house and provide support to the new employment stimulated by this industry. Development would occur in existing towns convenient to plant location. Urban construction would probably take place concurrently with plant construction, in order for the urban facilities to be available for the operating employees when the plant construction would be completed. In calculating the amount of urban materials that would be purchased

Table V-5. Oil Shale Capital and Operating Costs.
Note - These estimates, which include general environmental safeguards, may be expected to vary at least 10 percent.

Millions of Dollars

Mining option	Plant capacity,[1/] thousand bbl/day 10	50	100	150	300
Underground with Mine Disposal					
Capital costs:					
Labor	14.6	35.2	51.2	92.4	---
Equipment	44.7	187.2	272.5	349.7	---
Total	59.3	222.4	323.7	442.1	---
Annual operating costs:					
Labor	5.3	11.2	15.8	18.8	---
Supplies	3.9	14.9	22.9	29.1	---
Total	9.2	26.1	38.7	47.9	---
Open Pit with Backfill					
Capital costs:					
Labor	11.5	35.2	---	92.4	147.8
Equipment	45.0	178.5	---	333.6	533.7
Total	56.5	213.7	---	426.0	681.5
Annual operating costs:					
Labor	5.3	11.2	---	18.8	22.2
Supplies	2.9	11.9	---	20.6	32.9
Total	8.2	23.1	---	39.4	55.1
In Situ (non-nuclear fracturing)					
Capital costs:					
Labor	---	19.8	---	---	---
Equipment	---	213.9	---	---	---
Total	---	233.7	---	---	---
Annual operating costs:					
Labor	---	13.1	---	---	---
Supplies	---	2.7	---	---	---
Total	---	15.8	---	---	---

[1/] Except for in situ, capacity is based on Bureau of Mines gas combustion retort and is in terms of semirefined shale oil and 1970 dollars.

Table V-6. Plant Equipment and Urban Materials[1] Purchased.

Millions of Dollars

Year	Plant equipment	Urban materials	Total
1973	44.7	10.4	55.1
1974	232.2	35.4	267.6
1975	178.5	39.5	218.0
1976	178.5	39.5	218.0
1977	136.3	31.6	167.9
1978	303.0	19.2	322.2
1979	380.6	41.8	422.4
1980	174.9	67.4	242.3
1981	341.6	50.8	392.4
1982	433.6	56.8	490.4
1983	266.8	44.2	311.0
	2,670.7	436.6	3,107.3

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[1] Urban construction is estimated at $45,000 capital cost per household for new residential, commercial, and community facilities. Of this total, $30,000 is allocated to materials and $15,000 to labor.

(table V-6), it has been assumed that no appreciable capital investment would be made for the benefit of temporary construction employees that cannot be used by the permanent operating employees. As shown, over $400 million may be spent for urban construction materials over the 1973-83 period.

Because a manufacturing base does not currently exist within the seven counties that comprise the oil shale region, it has been assumed that all plant and urban construction materials would be purchased outside the region during this period. Together, these expenditures (table V-6), would total about $3 billion over the ten year period beginning in 1973.

2. Employee Incomes. The projected amount of salary spent was used to approximate the income that would be spent within the region, an assumption that would be true only if the total value of tax payments leaving the region equals the value of the profits that remain. As shown in table V-7, about $1.2 billion would be paid as salaries to construction and construction support employees and about $800 million to operating and urban support employees. Of the $2.0 billion total, $1.8 billion, or nearly 90 percent of the gross salaries, should remain within the oil shale region.

3. Tax Flows. Total taxes and public revenues should increase to about $500 million per year by 1983 (table V-8). These

Table V-7. Salaries and Distribution.

Millions
of
Dollars

Year	Gross salaries			Salaries spent within region		
	Construction 1/	Operating and support 2/	Total	Construction 3/	Operating and support 4/	Total
1973	27.6	0	27.6	23.9	0	23.9
1974	89.5	8.4	97.9	77.5	8.4	85.9
1975	76.4	27.0	103.4	66.1	27.0	93.1
1976	76.4	37.2	113.6	66.1	37.2	103.3
1977	57.6	55.8	113.4	49.8	55.8	105.6
1978	113.2	62.5	175.7	98.0	62.5	160.5
1979	120.8	73.9	194.7	104.5	73.9	17[illegible]
1980	111.1	95.7	206.8	96.1	95.7	191.8
1981	163.8	125.9	289.7	141.7	125.9	267.6
1982	206.5	137.3	343.8	178.7	137.3	316.0
1983	133.5	172.7	306.2	115.5	172.7	288.2
	1,176.4	796.4	1,972.8	1,017.9	796.4	1,814.3

1/ Includes construction support. Plant and urban construction salaries assumed to be $12,000 per man per year.

2/ Includes urban support. Operating salaries assumed to range from $8,600 to $9,700 per man per year depending on the size of the plant. All support salaries were estimated at $7,500 per man-year.

3/ Includes construction support. Assumes that one quarter of the construction worke[illegible] will not bring their families into the region and that these workers will spend on[illegible] one quarter of their salaries in the region.

4/ Includes urban support.

Table V-8. Taxes and Public Revenues Generated by Oil Shale Development.

Millions of Dollars

Year	Federal	State[1]	Local[1]	Total
1973	3.4	2.8	0	6.2
1974	22.6	13.9	1.8	38.3
1975	49.5	16.5	8.5	74.5
1976	70.0	19.7	13.8	103.5
1977	95.3	22.0	20.5	137.8
1978	118.8	32.1	24.2	175.1
1979	149.9	41.4	30.6	221.9
1980	179.6	40.4	37.9	257.9
1981	248.0	58.1	51.8	357.9
1982	282.2	68.5	59.2	409.9
1983	365.0	77.4	79.9	522.3
	1,584.3	392.8	328.2	2,305.3

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[1] State and local tax rates applicable in Colorado were used to estimate regional tax revenues. Federal revenues are independent of State location of plant sites.

amounts would accrue as follows: 70 percent to the Federal Government and 15 percent each to State and local governments. The Federal share by 1983 would be $365 million, derived mainly from the income tax payments of shale oil producers and and from the federally retained portion of the royalties collected. State revenues would reach $77 million per year by 1983, derived mainly from State income tax on oil shale profits ($29 million) and that portion of the royalty payment rebated to the States ($25 million). The State use tax on materials brought into the State for shale plant construction would amount to $8 million in 1983. This tax could be even larger during some of the earlier construction years. Individual income tax, other business income tax, sales tax, and use tax on other construction materials make up the remaining $15 million.

Local taxes, which are essentially property taxes, would total $80 million in 1983. The oil shale producers would pay $8 million tax on resource value and $61 million on plant value. Taxes on other private property would add another $11 million.

D. Summary

The growth of an oil shale industry would be characterized by large migrations of new people into the area. Temporary employment generated by development should provide employment for up to 20,000 people and total new jobs could approximate 36,000 by 1982. Assuming that an oil shale industry continues to develop, no unusual problems associated with the introduction of new construction personnel are anticipated. Many would remain in the region, moving between different installations. There could be a problem associated with existing urban facilities during construction, since at any individual site the temporary population during construction would be more than double the permanent population at the site when construction is completed. Capital expenditures for urban development should be self-liquidating. The mortgages on private residences could be paid out of wages received by individuals; mortgages on commercial construction could be paid out of business income. Public facilities could be financed by municipal bonds, to be redeemed from local taxes (table V-9). However, there will be a short time lag between the outlays for new public facility construction and the receipt of the local tax revenues generated by the shale oil plant. The type of financing required for these public facilities would depend upon the proportion of tax receipts that could be allocated to debt refunding and to operating expenses.

A number of Federal programs may be made available to help support community development. In addition, State programs may be needed

Table V-9. Comparison of Local Tax Receipts Generated by Oil Shale Industry and Expenditures for New Public Construction.[1]

Millions
of
Dollars

Year	Tax receipts	Construction expenditures	Net public funds available[2]	
			Annually	Cumulative total
1973	0	3.5	(3.5)	(3.5)
1974	1.8	11.8	(10.0)	(13.5)
1975	8.5	13.1	(4.6)	(18.6)
1976	13.8	13.1	.7	(17.4)
1977	20.5	10.5	10.0	(7.4)
1978	24.2	6.4	17.8	10.4
1979	30.6	13.9	16.7	27.1
1980	37.9	22.5	15.4	42.5
1981	51.8	16.9	34.9	77.4
1982	59.2	18.9	40.3	117.7
1983	79.9	14.7	65.2	182.9
	328.2	145.3		

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[1] For the 6 sites of table 1.

[2] These funds would be used for construction and operating expenses, and debt service.

to guarantee or underwrite local bond issues. Master plans and zoning regulations for many of the counties within the oil shale area have been enacted or are well on their way toward enactment. There would be a need to coordinate these plans for local development with State and Federal plans. As part of its responsibility in stimulating oil shale development, Interior would help bring together the Federal and State agencies needed to supplement local community planning in preparing these communities for a new industry.[1/]

[1/] The environmental aspects associated with urban development have been considered in: U. S. Department of the Interior, Draft Environmental Impact Statement for the Prototype Oil Shale Leasing Program, June 1971.

VI. Energy and the Need for Liquid Fuels

This Chapter outlines the availability of the major energy supplies needed to achieve economic growth. The petroleum situation is analyzed in depth and the potential role of shale oil is assessed.

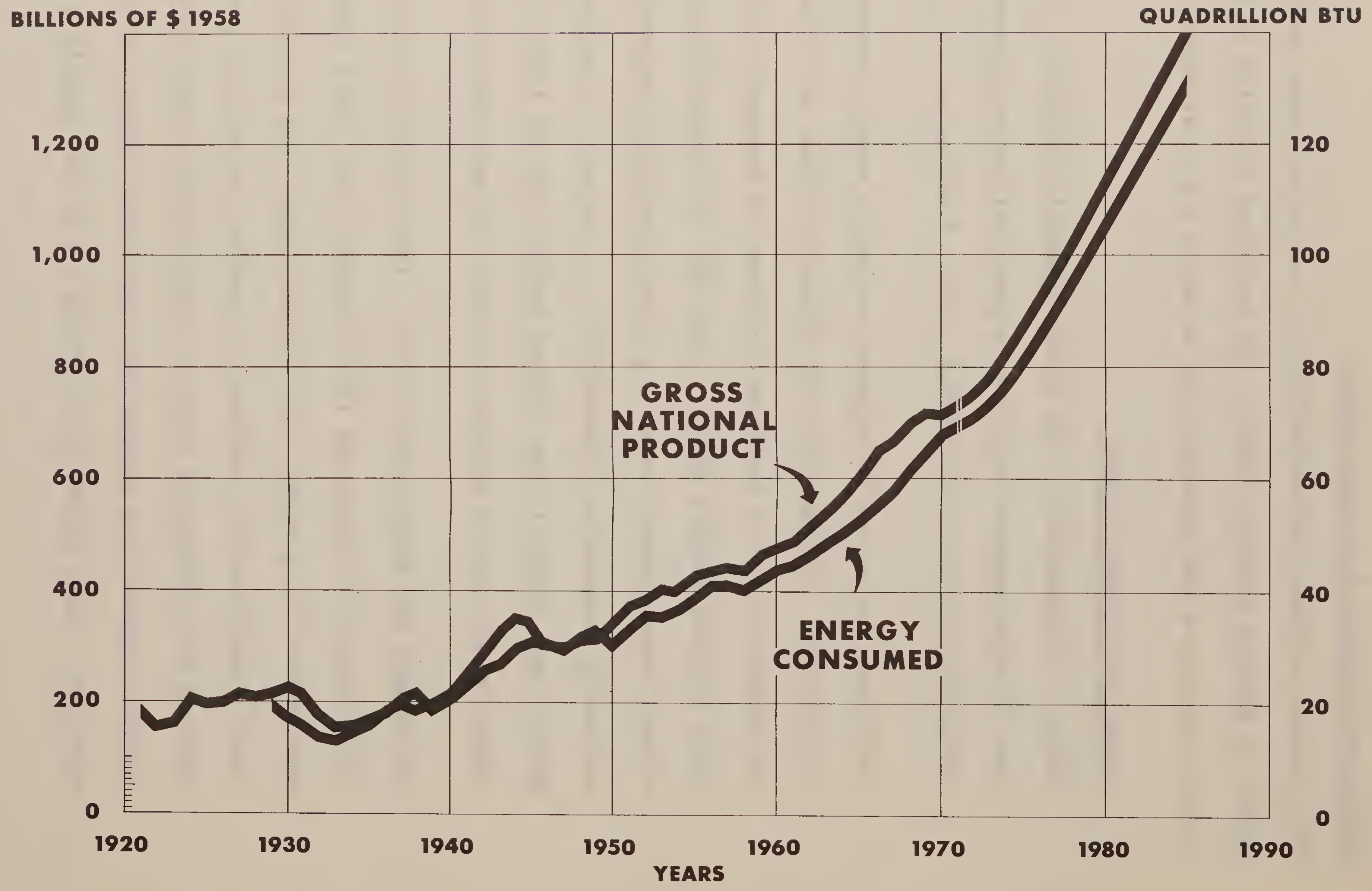
A. Energy and Economic Growth

Energy is fundamental to any modern industrial society. This fact is often apparent only when a power failure or a natural catastrophe deprives the general public of energy and its benefits.

The United States has the highest per capita energy consumption in the world. We also enjoy the highest standard of living and the largest output of goods and services, as measured by the Gross National Product (GNP). Since GNP is essentially a measure of work accomplished, there is a close correlation between GNP and energy consumption (figure VI-I). If we are to continue to enjoy a real growth in our economy between now and 1985, our energy supply must be expanded at about the same rate as GNP.

The demands for energy are currently (1970) provided by petroleum (43.0 percent), natural gas (32.8 percent), coal (20.1 percent), water power (3.8 percent), and nuclear energy (0.3 percent). These commodities will continue to provide the Nation's energy needs in the foreseeable future. Rising concern about the environment, however, has changed the traditional concepts of fuels selection. Until recently, selecting a fuel was largely a matter

Figure VI-1. Energy Use and Gross National Product



Oil and Gas May 1971

of choosing one with the lowest overall costs. Today, however, the environmental effects of producing, processing, and utilizing each of the available fuels must be considered. This complex system has recently been assessed.[1/] Efforts to achieve minimum environmental degradation, as outlined below, have contributed to this Nation's energy gap, which has assumed major porportions.

B. Available Energy Options

1. Natural Gas - The preferred fuel for environmental reasons, domestic natural gas is unlikely to continue to provide the share of energy requirements which it currently supplies.

   Discoveries of gas have declined drastically over the past 2 years, and additions to proved reserves have amounted to less than one-half of the volume withdrawn for use. Exploratory activity is at a 10-year low.

   Gas shortages in local areas throughout the Nation are already being noted, and these are expected to increase to serious proportions by 1973, when growth of gas consumption is expected to be limited by the deliverability of existing proved reserves.

2. Coal - The growth of coal is likely to be restrained by air quality restrictions for at least the next 5 years.

[1/] G. Alex Mills, et al., "Fuels Management in an Environmental Age" Environmental Science and Technology, V. 5, No. 1, January 1971

Replacement of high-sulfur coal with coal of low-sulfur content from western mines will require new mine development and expansion of coal transportation facilities. Coal costs have increased substantially, and other approaches to the clean utilization of coal now being developed - gasification and stack emission control - are at least 5 to 10 years from widespread commercial application. Where natural gas is not available, utilities have been converting facilities to use low-sulfur oils as a means of meeting sulfur emission standards.

3. Nuclear Power - Nuclear power capacity, though growing, is lagging behind earlier timetables and is more expensive than estimated. Nuclear plant construction is running 2 to 3 years behind schedule, with an overall lead time of 6 to 7 years required for new nuclear plants. In addition to unforeseen technological problems, the nuclear industry has also encountered public concern and resistance to thermal pollution and potential radiation hazards--factors which may delay nuclear development further. Nuclear capacity in 1980 may be at least one-third less than earlier published forecasts, a growth rate which will not be sufficient to meet incremental U.S. energy needs for at least the next decade.

4. Hydroelectric Power. - Hydroelectric power is expected to continue to grow, but to be of decreasing relative importance and to supply the smallest amount of any of the commercial energy sources in the years ahead.

5. Petroleum. - U.S. demand for oil is growing much faster than the available domestic supply. Exploratory activity has been declining since 1957, which has led to a similar decline in discoveries. Additions to proved reserves have been less than withdrawals in 6 out of the past 10 years, and our ability to produce oil declined in 1968, 1969, and 1970. The United States could have supplied, without imports, all of its requirements for petroleum from domestic fields until 1967. We are now some 1.5 million barrels per day short of being able to do so, and dependence upon foreign sources is increasing at a rate of about one-half million barrels per day with each passing year.

Our increasing dependence on foreign oils has been brought about by two converging trends: (1) The increased use of oil to help offset the supply lag by the other energy commodities, and (2) our decreasing ability to meet the increased oil requirements from domestic sources. The convergence between demand and supply has important political and economic implications that are analyzed in the discussion which follows.

C. Petroleum; Historical Perspective

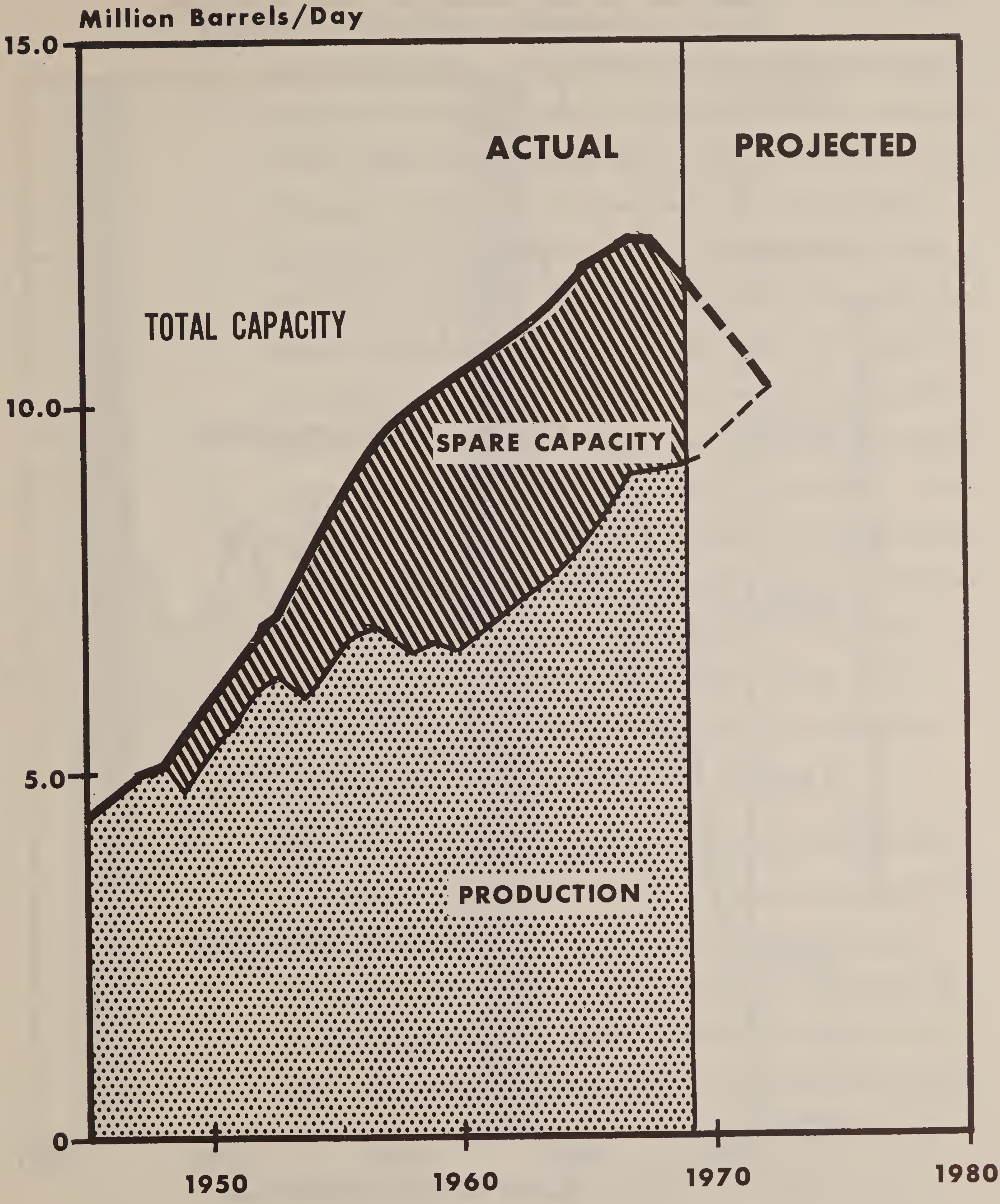
The present oil situation is the result of events that began 25 years ago, when demand for all goods and services exploded following the relaxation of World War II controls. Responding to sharply higher demands for oil, the petroleum industry increased exploration and applied newly developed production technology.

At the same time, rising foreign oil imports began to dampen the growth in demand for domestic oil and demand was further slowed following our 1956-58 recession. Our ability to supply oil, therefore, increased much faster than demand, and large amounts of spare producing capacity developed (Figure VI-2). The oversupply conditions peaked in 1964, when the Nation could have increased production by nearly 40 percent. Over most of this period, the wholesale price of oil remained virtually unchanged.

With an ever-increasing amount of supply and a relatively stable wholesale price, the petroleum industry had neither the need nor the economic incentive to spend money to develop new oil supplies (Figure VI-3). However, large sums of money have been expended in recent years to acquire leases, which strongly suggests that the industry has been preparing a base for renewed exploration and development.

New additions to productive capacity must be developed if this Nation is to continue to have some spare capacity for emergency conditions, since all of the spare capacity we now have will be gone by 1973 or earlier at the present decline rate. Over the short term, these trends can be altered by technology, prices, and foreign oil imports. Over the longer term, the development of the Nation's vast supplemental energy sources can provide the flexible supply options that will be needed to stabilize the energy situation.

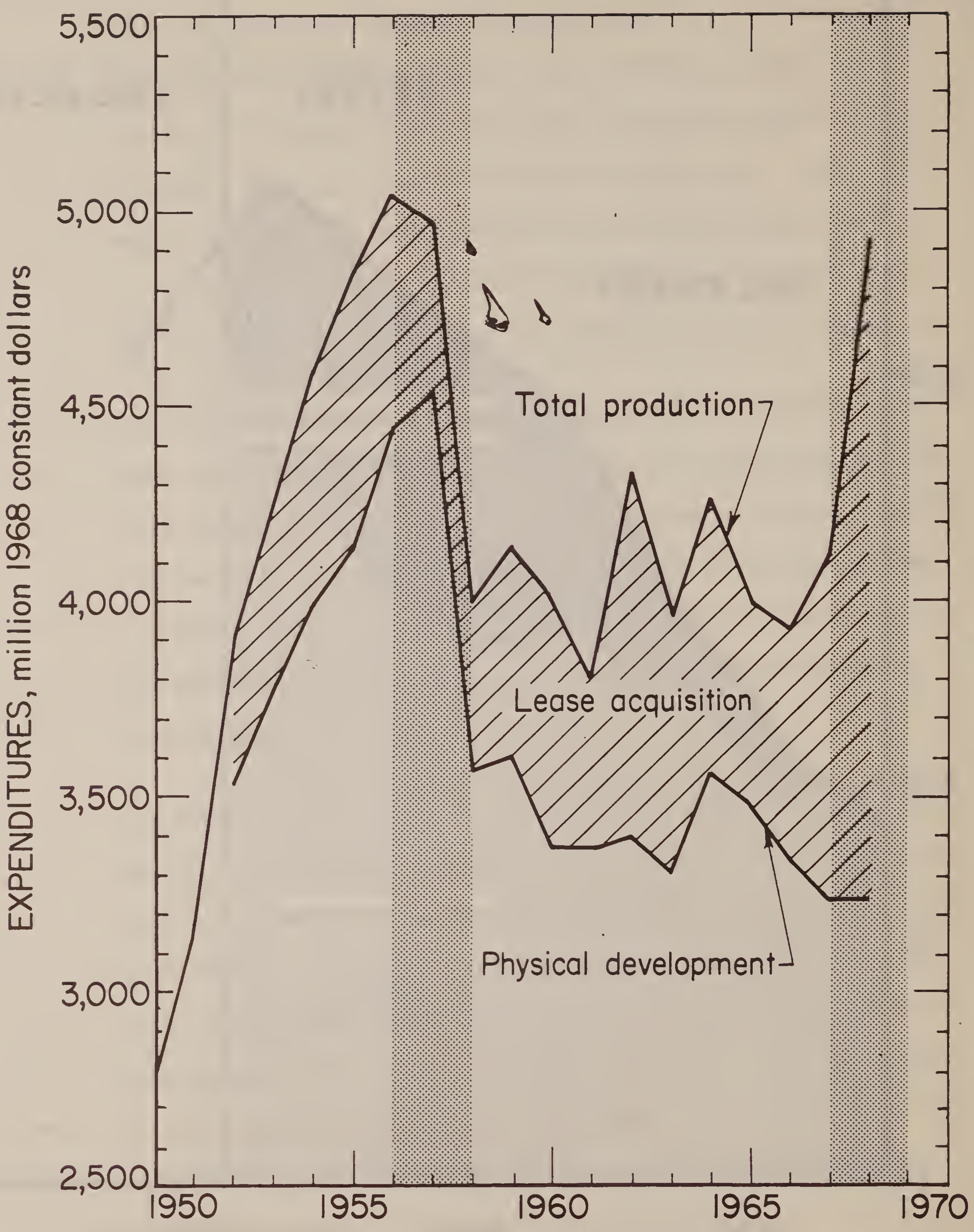
Figure VI-2. U. S. Crude Oil Producing Capacity



OFFICE OF OIL AND GAS
DEPARTMENT OF THE INTERIOR
(Excludes Alaskan North Slope)

JANUARY 1971

Figure VI-3. - Expenditure for total production, lease acquisition, and physical development.



Source: The Chase Manhattan Bank.

Illustration from Bureau of Mines Information Circular 8472, 1970.

D. Petroleum; Future Supply Options

1. **Crude Oil Recovery**. - The recovery of petroleum from known oil fields has followed a gradual evolutionary process, responding to both improving technology and the changing character of the discovered fields. The earliest period of the petroleum industry was characterized by a lack of understanding about how best to produce oil, and many fields were abandoned following the cessation of primary flush production. Substantial improvements in oil recovery were made during the 1920-40 period, with the discovery of many of the Nation's major natural water-drive fields (East Texas, for example). After 1940, the overall trend was the discovery of oilfields which were not capable of yielding as high as a recovery efficiency as those discovered in the 1920-40 period. The decline in reservoir quality, however, was gradually offset by the introduction of formation fracturing and the large-scale application of secondary recovery.

   A constantly improving production technology has permitted the average recovery from a field to increase at an estimated annual rate of about 0.5 percent over the past 20 years. This trend is due mainly to the injection of water into oilfields to supplement or replace the natural energy of the field. Improvements are being made, but the types of oilfields now being found are not as susceptible to this technique as those that were found in the past.

The interrelationship between price, technology, and supply is illustrated in Figure VI-4. 1/ As shown, the amount of "proved reserves" plus those estimated as "economically producible" at current prices totaled about 49 billion barrels in 1965. An additional 22 billion barrels was estimated as physically recoverable using conventional fluid injections, but this oil is contained in marginal fields and the application of the technology is more costly. The last category in Figure VI, "recoverable using new technology," refers to the application of miscible fluid drive and in situ combustion to recover oil, but widespread application of these techniques could be justified economically only if the price of oil were to advance significantly. Complete adoption of all recovery methods where applicable to existing oilfields can physically recover nearly 100 billion barrels of oil from these fields.

Production of crude oil from known reservoirs, therefore, depends on both technology and oil prices. Higher prices and/or improved technology would make it profitable to extract substantial amounts of additional oil from fields

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1/ The Interstate Oil Compact Commission last made estimates in 1965 of the amount of oil that could be produced by secondary recovery if such techniques were actually applied to known oilfields. Since that time, proved reserves of crude oil, as estimated by the American Petroleum Institute, had fallen to 29.6 billion barrels by the end of 1969. Although the data are dated, the supply-price concept discussed above is valid.

Figure VI-4. Petroleum Recovery Depands on Price and Technology.

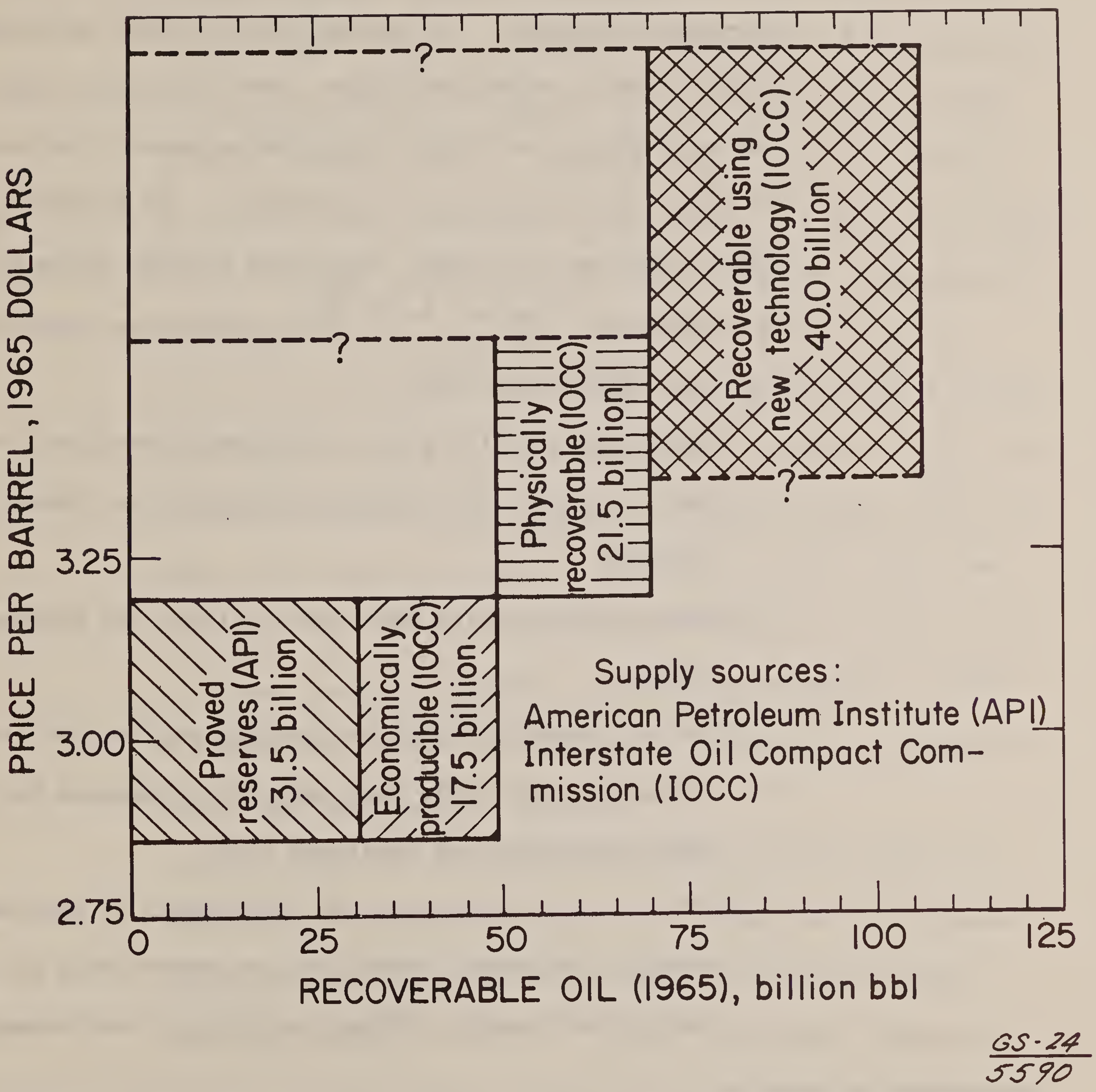

Illustration from Natural Resources Journal, vol. 11, No. 1, January 1971.

which are now economically marginal. Our ability to continue to advance technology and the economic availability of energy supplies from oil shale, coal, and tar sands will determine future price relationships for energy sources.

2. Increased Discovery. - No matter how efficient and sophisticated recovery techniques become, they necessarily must follow and depend upon initial discoveries made by exploratory drilling. Since the act of discovery is the genesis of proved reserves, discovery trends and related technology have been intensely studied.[1, 2, 3] The voluminous data developed in these efforts show that -

- Exploratory drilling has consistently declined for the past 14 years, the longest decline in the history of the industry.
- New oil discoveries have also followed the downward trend.
- The oil deposits found are getting smaller and less lucrative, since the most favorable prospects have been discovered and developed first.
- The cost of exploration and development is increasing sharply, as deeper formations are probed both on land and in more costly offshore and Arctic environments.

1/ National Petroleum Council, Factors Affecting U.S. Exploration Development and Production 1946-65 Washington, D.C., 1967, 163 pp.

2/ National Petroleum Council Impact of New Technology on U.S. Exploration and Production 1946-65 Washington, D.C., 1967, 341 pp.

3/ U.S. Department of the Interior U.S. Petroleum Through 1980 Washington, D.C., 1968, 92 pp.

- Discovery technology is in a mature state of development and only evolutionary improvements can be expected.

The 1968 discoveries of oil on the North Slope of Alaska and in some offshore areas are exceptions to the record of the U.S. petroleum industry, which can otherwise be characterized as a mature extractive industry well into the decline stage of its discovery cycle. Although many billions of barrels of oil have been discovered in the Artic, oil from this region will be limited by the availability of adequate transportation to markets. Under favorable conditions, about 2 million barrels per day of oil from Alaska will be available by 1980. While this involves a significant amount of oil, it will only supply a fraction of the increase in demand between 1970 and 1980. The United States must continue to look to the lower 48 States and the Outer Continental Shelf for a major portion of future domestic supplies. Production increases in those areas can only occur if the tempo of exploration is significantly and successfully expanded.

Extensions of old fields and discoveries of new fields at conventional or greater depths are forecast for all regions covered by the extensive study completed by the National Petroleum Council in 1970.1/ Indeed, the total volume of

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1/ National Petroleum Council Future Petroleum Provinces of the United States - A Summary Washington, D.C., 1970, 138 pp.

undiscovered oil and gas in this Nation is expected to equal or surpass the volume that has been discovered from 1859 to the present. However, there is little likelihood of a technical breakthrough that will significantly alter discovery rates.

It is not possible to accurately predict the amount of oil that will be discovered and recovered in the future. Advances in exploration and recovery technology, the randomness of discovery, economic incentives, and Government policies related to leasing, foreign oil imports, taxation, and supplemental source development all bear directly on future oil supplies from domestic sources. But even if a significantly increased exploratory effort were started immediately and were highly successful, several years would be required before the new discoveries could be developed into producing oil fields with significant output. Faced with the difficult supply-price problems that have arisen in recent years, attention has turned to increased foreign oil imports as an alternative supply source.

3. Foreign Oil Imports - The United States is critically dependent upon liquid and gaseous fuels that presently can only be obtained, in the quantities needed, from conventional petroleum sources, both foreign and domestic. This fact will remain true for the next 10 or more years regardless of the progress made in the extraction of liquids and gases from

coal and oil shale, because long lead times are necessary to develop these supplemental sources. The adequacy, security, and cost of our petroleum supplies have a direct influence on our national product, our trade position, our diplomatic posture, and our military capability.

Under these circumstances, Government has the responsibility to encourage a favorable administrative and economic climate under which the Nation's petroleum industry can provide oil and gas supplies that are both secure and adequate, and at the lowest practicable cost. In addressing itself to this responsibility, the Federal Government in 1959 made the fundamental determination that unless the domestic market were shielded from foreign supplies, too large a share of it would eventually come to be dependent upon foreign sources, subject to denial by either political or military action. With security of supply as the primary criterion to be satisfied, a policy and program restricting foreign oil imports to a moderate fraction of domestic production was enacted.

Convincing evidence of the wisdom of the decision lies in our proven ability to adjust to the major disruptions of world petroleum supply and transportation resulting from the political instability of the Middle East. In 1951, the seizure and shutdown of oil facilities in Iran virtually stopped all oil exports from that country for over 2 years. The Suez Canal, closed by Egypt for a period of 5 months in 1956, was again closed in 1967, and remains closed at the time of this writing. The 1967 outbreak of hostilities between Israel and the Arab Nations interrupted, for a brief interval, over two-thirds of the oil supply to Western Europe. Moreover, a 2 months' embargo was imposed on oil shipments to the United States, the United Kingdom, and the Federal Republic of Germany by certain oil-exporting nations. The Trans-Arabian pipeline was ruptured in May 1970. Its repair was delayed by the Syrian Government throughout the balance of the year. Concurrently, the Libyan Government sharply curtailed production from oilfields located in that country. These actions placed tremendous pressure on the world's tanker fleets, forcing upward the costs of chartering tankers to transport this crude. By the fall of 1970, the "Cheap and Plentiful" foreign oil---the foundation for those who support unlimited imports---was neither cheap nor plentiful since Middle East crude delivered to New York offered no savings over that produced domestically.

These interruptions in oil supplies occurred at a time when substantial switches from coal to imported residual oil were being made to meet environmental standards. Sharply increased residual oil demand and limited availability of transport caused the price of residual oil to increase by nearly 65 percent over the first 10 months of 1970. No alternative currently exists for residual fuel oil, and even substantially higher prices do not assure adequate supplies in all locations. This unfortunate development is the result of overdependence on foreign sources and lack of adequate transportation. Today, nearly 94 percent of the East Coast demand for residual oil is supplied by foreign imports. Of even greater concern, the supply source is shifting from the relatively secure South American oil fields to those of the more unstable North African area, as suppliers seek the low sulfur oil needed to meet environmental standards.

In the case of crude oil, spare domestic supplies have been drawn down. Production from wells located principally in Texas and Louisiana was increased, and by November 1970, total production exceeded 10 million barrels per day for the first time in the Nation's history. This daily production rate, 500,000 barrels (or about 5 percent) greater than the average rate during the first 6 months of 1970, served to replace the deficit in overseas supplies. This action was possible during 1970, but by 1973, spare productive capacity may be eliminated and it would no longer be possible to increase the oil output from Texas and Louisiana wells.

The 1970 broken pipeline in Syria and production cutback in Libya affected less than 3 percent of the free world's oil supply, but this 3 percent is all it took to force a major readjustment in world movements of oil. Today, about

40 percent of the total oil needs of the world are supplied by output from fields located in the Middle East and Northern Africa. These areas, moreover, have about 70 percent of the free world proven oil reserves. Thus, the rapid increases in world demand that are now taking place must force increasing reliance on these highly unstable supply sources. A new dimension to international oil movements must also now be considered---the demonstrated ability of the oil-exporting nations to act both separately and in unison to attain specific economic objectives at the expense of both the oil companies and consuming nations. Increasingly, the exporting nations have won price concessions from producing companies which ultimately must be paid for by consumers. The balance has now been tipped in favor of the oil exporting nations.

Oil is being used increasingly as a tool for obtaining political and economic objectives. In its supplemental energy fuels, however, this Nation has within its own borders the oil equivalent of several Middle East oilfields. Technology for economic production of this oil from our oil shale, coal, and tar sand resources must be developed if oil supplies from these sources are to be available when needed.

4. Supplemental Sources - Each of the supplemental sources[1] contains vast quantities of recoverable solid organic materials that are convertible to liquid and gaseous products. The oil represented by all of these deposits in place is not measured

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[1] Coal, oil shale, tar sands.

in billions of barrels, as is petroleum, but in trillions of barrels.

Most recent studies indicate that each of the supplemental sources is nearly competitive economically with crude oil using processes currently known but not yet commercially proved. Moreover, these processes involve large-scale material handling, which lends itself to technological breakthroughs that may lead to substantial cost reductions. Scaling up from the current prototype development state to multi-billion-dollar industries will require years to plan and construct both the industry and supporting communities. In addition, the commitments of capital required for construction of operating plants alone will range from $3,000 to $5,000 per daily barrel of production; or from $3 billion to $5 billion for a 1-million-barrel-per-day output.

Oil shale economics have significally improved relative to crude oil since this Department completed its last comprehensive analysis.[1/] Beetween 1966 and 1970, for example, costs have increased about 45 cents per barrel for the system identified in the referenced study as the "improved first generation" retorting option. This cost increase, however, has been balanced by crude oil prices, which have risen by about $0.45/bbl. In addition, the Tax Reform Act of 1969

[1/] U.S. Department of the Interior Prospects for Oil Shale Development, Colorado, Utah, and Wyoming Washington, D.C. 1968, p. 65.

changed the point of application for calculating depletion from the oil shale before entering the retort to the shale oil as it leaves the retort, a change which increased the tax allowance by about $0.15 per barrel. Since shale oil economics have remained about unchanged or have been slightly improved, while those of crude petroleum have declined, the economic viability of shale oil production has been enhanced when compared to crude petroleum. The alternative that proves to be most economical will depend on the positions of individual firms as they evaluate their resource situations and future needs. Many firms may meet their needs only through exploration and development of conventional sources; others will also move toward the development of alternative sources.

The state of technology, the size of the investments required to develop supplemental sources as compared to alternative investment opportunities (Alaskan and offshore oil), and the planning and associated long lead time indicate that oil production from any of the supplemental sources cannot be a significant part of total supplies until after 1980. The potential for the more distant future, however, is great.

E. Oil Shale Potential

The demand for petroleum will continue to increase, but rapid and recent changes in the pattern of energy consumption have made the rate at which this demand will grow particularly difficult to project at this time. The Bureau of Mines estimates the growth rate of petroleum demand at about 3 percent per year.1/ At this rate, consumption in 1985 would increase 50 percent over that of 1970; that is, from 5.3 billion barrels to 8.0 billion barrels annually. More recently, however, petroleum demand has been increasing at a rate in excess of 4 percent annually. There is reason to believe that this growth rate will continue, especially since recent environmental control efforts tend to further increase oil consumption, as do the increasing difficulties in meeting market requirements for natural gas. At 4 percent, the annual demand for petroleum would reach nearly 9.7 billion barrels by 1985, a level nearly 85 percent greater than 1970. The magnitude of future supply challenges can only be grasped by comparison with past petroleum consumption.

Over the entire 110-year period prior to 1970, this Nation consumed a little more than 100 billion barrels of oil. The need for this commodity is now so great that, even at the lower 3-percent growth projection, consumption over the next 15 years will approximate the volume consumed over the previous 110 years.

1/ Morrison, Warren E., and Charles L. Readling An Energy Model for the United States Bureau of Mines I.C. 8684, 1968, 127 pp.

If the real price of domestic crude oil is not to be increased, U. S. production of crude oil and gas liquids, including production from the North Slope of Alaska, may amount to about 5.3 billion barrels per year in 1985. This level of production, nearly 30 percent more than the current producing rate, would leave the United States dependent on foreign sources for 45 percent of its supplies at a 4-percent growth rate; or 35 percent at a 3-percent growth rate. If demand should grow at the 3-percent rate, and economic incentives are adequate to permit 75 percent of our oil requirements to be met by domestic production, imports would still increase from 1.33 billion barrels in 1970 to 2.0 billion barrels in 1985.

Even though the specifics of future U. S. petroleum supply and demand are difficult to pinpoint precisely, it is evident that development of our supplemental energy sources is needed to diminish the impact of future consumption increases.

As detailed in Chapter V, commercial shale oil production, under the most optimistic estimate, could begin about 1975 at a rate of about 18 million barrels per year (50,000 barrels per day), on the basis of anticipated technologic progress. The first generation technology needed for this rate of production will be improved from 1976 to 1980. This development stage will be reflected by only small increases in annual production of about 18 million barrels per year as the new technology is applied.

By 1980, a productive capacity of more than 100 million barrels per year (300,000 barrels per day) could be established. More importantly, the technology probably will have been advanced to the point where large incremental increases in production could be achieved. Also, the nucleus of people, supporting services, facilities, and experience needed for this expanded effort will have been established.

After 1980, the second generation extraction-retorting systems would be expected to permit annual additions to shale oil productive capacity of about 37 to 73 million barrels per year (100,000 to 200,000 barrels per day). At these rates, the cumulative capacity in 1985 would total 300 to 500 million barrels per year (or 800,000 to 1,300,000 barrels per day).

Although shale oil would not provide a significant part of total oil supplies before 1980, the establishment of a proven technology and the development of support facilities are important to a national energy program for the future. If the high projection of petroleum requirements of an annual four percent increase is realized, and oil shale and other supplemental fuel development does not occur, our national energy alternative may be limited to increase petroleum imports from Eastern Hemisphere sources.

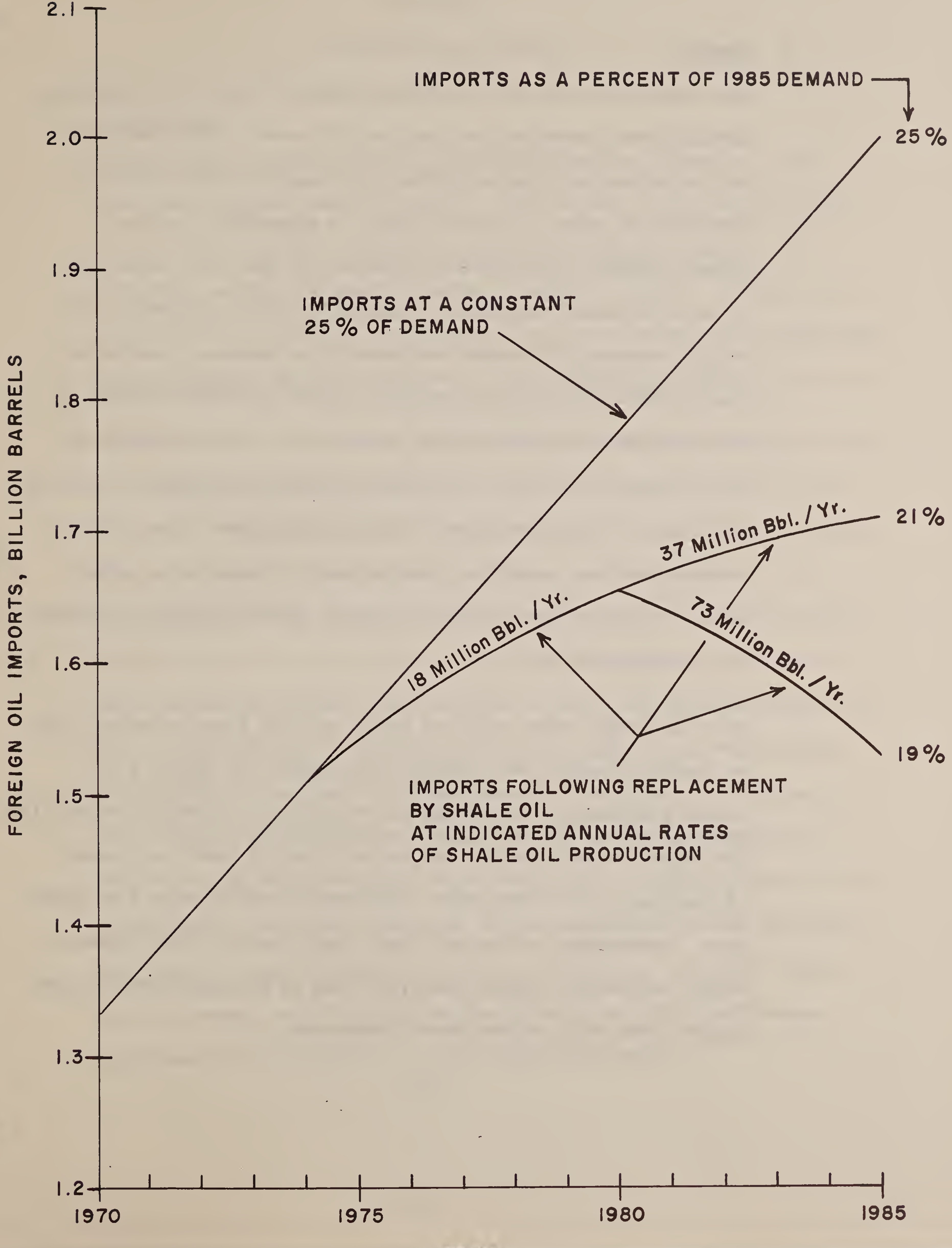
At the lower level of demand projections through 1985, the introduction of shale oil production could reduce the amount of new conventional petroleum supplies that would otherwise need to be found and developed and would help to curtail a growing dependence on imported oil. If the petroleum industry can continue to develop conventional supplies at reasonable costs, the entire increase in shale oil production can be used to offset increasing foreign oil imports. As shown in Figure VI-5, the lowest expected annual rate of shale oil additions after 1980 (37 million barrels per year) would permit the volume of imported oil to be held constant at about the 1980 level and by 1985 the United States' relative dependence on imported oil might be returned to 21 percent, about where it was until recently.

Even under the most favorable assumptions--minimum demand growth, a greatly expanded production of conventional domestic petroleum, and maximum anticipation of production of oil from shale--imports could not be reduced to less than 19% of our total petroleum requirements.

The use of oil from oil shale to offset imports from the Eastern Hemisphere will also reduce the strain on our international payments balance resulting from the purchase of foreign oil supplies.

Most importantly, 1985 can be regarded as only an intermediate point in long-term energy planning. Efforts over the next 10 to 15 years to initiate a viable supplemental fuels industry are essential if this Nation is to continue to satisfy long-range energy needs, which will continue to grow in the years beyond 1985.

Figure VI-5 Potential Impact of Shale Oil Production on Foreign Oil Imports



F. Summary

This Nation has now lost the large amounts of spare oil producing capacity that characterized the last 15 years. Every barrel of oil now extracted from our proved oil reserves needs to be replaced by an amount slightly larger, to compensate for the normal decline in the producing capacity of older oil fields and to meet the added requirements imposed by growth in demand. To satisfy minimum oil demands and provide an adequate reserve position in 1985 will require finding at least 75 billion barrels of economically producible oil--an average of 5 billion barrels per year. Currently, from 2 to 3 billion barrels are added to reserves each year. It has been nearly 20 years since more than 4 billion barrels have been added in a single year. A substantial effort will be required over the short term to satisfy future oil demands at reasonable prices.

Over the longer term, oil from shale can help place an upper limit on crude oil prices and significantly reduce the Nation's increasing dependence on foreign oil supplies of uncertain reliability. The impact on both imports and crude oil price would be greater if supplies of oil from other supplemental sources were also available. Development of our oil shale, coal, and tar sand resources offers substantial future benefits, both to the Nation and to the regions that will support these industries.

APPENDIX A

CORE DRILLING PERMITS

I. Introduction

Informational core drilling is being authorized on Federal oil shale land under special land use permits. The purpose of the core drilling is to enable detailed evaluation of the environmental aspects, the hydrology and the oil shale resource of specific sites. A notice that applications for core drilling permits will be received by the Department of the Interior is being published in the Federal Register at this time.

Generally, the core drilling authorization provides for (1) applications by the public to drill for geologic and resource information; (2) approval of the applications by the Department of the Interior; (3) supervision of core drilling by field officials of the Department, to insure compliance with regulations and permit terms and to avoid environmental damage; (4) publication of notices in newspapers and journals for a period of not less than 120 days to permit multiple participation, on a pro rata basis, in drilling projects in order to provide maximum availability of data and a minimum amount of drilling; (5) sharing of all data with the Department, acting for the Federal Government, at no cost to the Government; (6) confidentiality of resource data (but not environmental data) made available to the Department for not more than five years or until the permit lands are leased for oil shale, whichever is sooner; and (7) incorporation in each permit of performance requirements to accomplish the above-mentioned goals.

An application shall include, as required, a description of the proposed exploration program, including a description of the lands and the number and location of holes to be drilled. General informational core drilling is expected to continue through 1972. Nominations of lands for leasing shall be received through January 1972. Informational core drilling shall be permitted on nominated tracts.

A. Core Drilling Permit Provisions

General and special stipulations pertaining to permit operations and environmental protection and control, similar to those planned for inclusion in any oil shale lease, shall be incorporated into each coring permit issued by the Department, including stipulations concerning field operations, restoration of land, and other provisions appropriate to the exploration. It shall be required that, before operations begin, a drilling plan must be submitted for approval by the Department. It shall be required that such a plan include location, drilling method, size of hole, size of core, length and size of casing, safety precautions, and abandonment procedures, as well as a schedule for work to be started and completed. Designated Departmental field officials shall have access to all operation sites and to data compiled in connection with operations. Proper completion and abandonment shall be carried out under instructions furnished by these field officials, and shall be completed within one month after expiration of the permit. Failure to comply with the terms and conditions of the permit shall be cause for cancellation of the permit and forfeiture of the permit bond, where appropriate.

The permittee shall be required, among other things, to (1) commence drilling operations within one year from the date of issuance of the special land use permit; (2) conduct his operation in such a manner as not to interfere with or endanger operations on any existing or future mineral lease, nor interfere with or endanger other land uses, and to safeguard the water and other natural resource values; (3) comply with all applicable Federal, State, and local regulations or requirements pertaining to these operations, including 43 CFR Part 23 and 30 CFR 231; (4) post a $5,000 bond with the Department for each special land use permit issued to cover damages that may be caused to the environment or resources, either on-site or off-site, by construction, maintenance, and use of roads or trails, or by other activities conducted under the permit; and (5) post a $5,000 bond with the Department for each informational core hole to be drilled, to assure compliance with regulations (30 CFR Part 231) for drilling and abandonment operations.

Examples of the types of general and special stipulations which shall be made a part of each permit issued under this program are as follows:

(1) Prior to commencing permit operations, the permittee shall submit to the Regional Mining Supervisor, U.S. Geological Survey (hereinafter referred to as "the Mining Supervisor"), for approval, a detailed description of the procedures to be followed to assure that the permit operations will meet and conform to the specific environmental criteria, controls and constraints, incorporated in the permit, which have been formulated by the Department for the express purpose of preserving and protecting the environment, including land, water, air, and other natural resources within the area in which the permitted premises are situated.

(2) The permittee shall use extreme care in permit operations to avoid any unnecessary disturbance of vegetation or soil within or outside the limits of the permitted premises, and he shall place erosion control structures, including water bars, in disturbed areas as designated by the appropriate Bureau of Land Management District Manager (hereinafter referred to as "the District Manager"). The permittee shall properly dispose of accumulated material, such as brush and slash, in accordance with the instruction of the District Manager, to minimize the fire hazard. The permittee shall not burn rubbish, trash, or other flammable material except in accordance with a plan approved by the District Manager and after issuance of a burning permit.

(3) The permittee shall, within one year after completion of operations, reseed, by appropriate means, all disturbed areas designated by the District Manager, in order to reestablish vegetal cover, minimize soil erosion, and minimize infestation by noxious weeds and poisonous plants. Seeding shall be accomplished between July 1 and October 30, after completion of operations. In the event that the first seeding is not successful, the permittee shall make a second seeding. The permittee shall advise the District Manager when seeding is to be started and when it has been completed. Seed, which must be of a type, quality, and germination rate approved by the District Manager, shall be sown at the rate of six pounds per acre.

(4) The permittee shall protect all survey monuments, bench marks, witness corners, reference and other monuments, and bearing trees against destruction, obliteration or damage during permit operations. If any monuments or corners are destroyed, obliterated,

or damaged by such operations, the permittee shall hire the appropriate county surveyor or a registered land surveyor to reestablish or restore at the same location the monuments or corners, using surveying procedures acceptable to the District Manager, and shall record such survey in appropriate county records. The District Manager may prescribe additional requirements for the protection of monuments, corners, and bearing trees.

(5) The permittee shall replace any fence or structure located on Federal lands that is damaged as a result of permit operations, and he shall install gates in the event frequent ingress or egress should become necessary.

(6) The permittee shall not modify or change the character of any water body or water supply, except upon advance approval in writing by the District Manager.

(7) The permittee shall notify the District Manager as soon as he commences operations and, again, when he completes operations so that a district representative may examine the permitted premises to determine whether the above stipulations have been met. All sumps shall be drained, filled and leveled so as not to present a hazard to livestock or wildlife. The permittee shall address all communications regarding these requirements to the District Manager.

(8) The permittee shall take such soil and resource conservation and protection measures on the land covered by the permit, and on roads and trails used as access to the lands, as the District Manager may request.

(9) The permittee shall indemnify the United States against any liability for injury or damage to life, person, or property arising from the occupancy or use of the lands under the permit.

(10) The permittee shall, upon termination of the permit, so far as it is reasonably possible to do so, restore the land to its original condition to the safisfaction of the District Manager.

(11) The permittee shall be bound by express conditions to the effect that (1) permit operations may not unduly interfere with the management and administration by the United States of the lands covered by the permit; (2) the United States, its grantees, other permittees, or lessees may occupy and use any part of the permitted premises not actually occupied or required for permit operations in connection with necessary operations which are incident to management and administration of those lands.

(12) The permittee shall, in order to minimize damage to any watershed or other water resources, cooperate with the District Manager in determining a proper location, design, and maintenance program for any access road or trail required for permit operations, and effectuate conservation measures preparatory to abandonment.

(13) The permittee's selection of the exact location of the drill hole collar shall be subject to the approval of the Mining Supervisor.

(14) The permittee shall allow any party who applies for participation during the period provided therefor to participate in the drilling program under the permit, provided said party agrees to pay his pro rata share of the cost of the drilling program.

(15) The permittee shall furnish all participants complete drill hole data, including location, logs, analyses, and other pertinent information.

(16) The permittee shall furnish the Mining Supervisor, for Government use, a one-fourth split of the core, together with such other information as may be required under 30 CFR 231.8. The Mining Supervisor or his representative shall have access at all times to the drilling operations, logs, cores, or other data necessary to evaluate the oil shale deposit. Daily reports, summaries and information required in 30 CFR 231.8 shall be furnished to the Mining Supervisor as soon as available, but not later than 48 hours after completion of any operations.

(17) The supervisor shall provide instructions for the completion and abandonment of field operations.

(18) Except as otherwise provided, completion and abandonment of all field operations on the tract of land described in this permit shall be completed one month after the expiration of the permit.

(19) The permittee shall submit to the Mining Supervisor all resource data obtained from drilling operations within thrity days after acquiring such data.

(20) The permittee shall advise the District Manager of water encountered during drilling operations so that if it is of suitable quality and quantity, it may be developed for beneficial use. Casing shall be left in any such hole and the permittee reimbursed for its value.

B. Publication of Notice

The following notice is being published in the *Federal Register*.

Notice That Applications for Permits to Conduct Informational Core Drilling on Oil Shale Lands in the States of Colorado, Utah and Wyoming Will be Received by the Department of the Interior.

1. Notice is hereby given that for a period of two years from the publication date of this notice in the *Federal Register*, applications for informational core drilling permits on oil shale lands may be filed in order to permit the evaluation of the environmental aspects, hydrology, and the oil shale resource of specific sites. Permits to drill may be obtained by filing an application for a special land use permit in accordance with the regulations in 43 CFR Part 2920 in the Bureau of Land Management Land Office having jurisdiction over the lands to be drilled (hereinafter referred to as "the Land Office"). The application may be by letter and must be accompanied by Form 9-331A (notice of intent to drill), together with a description of the proposed exploration program, including a description of the lands and the number and location of holes to be drilled. After an application has been filed, the proposed exploration program shall be made available for public inspection.

2. Applicants for permits shall be required to afford other parties a period of at least 120 days in which to participate in the proposed drilling program. Participation shall be subject to payment of a pro rata share of the cost of the program, as described in the application or as subsequently modified by the Regional Mining Supervisor, Geological Survey (hereinafter referred to as "the Mining Supervisor"). The applicant must publish a notice (three consecutive publications at 30-day intervals) in at least two mining or oil and gas trade journals and two newspapers of general circulation in the area where the lands covered by the permit application are situated. The notice must contain an invitation, open for a period of 120 days from the data of the first publication, to enter into participation in the proposed informational drilling program.

3. The notice referred to in paragraph 2, and the news sources in which it is to be published, must be approved by the Land Office. Copies of said notices must be filed with the Land Office upon publication and, thereafter, shall be posted in that Office. The names of parties electing to participate under a permit, if any, shall be furnished to the Land Office at the close of the period provided for election to participate.

   Prior to publication of the notice, the proposed exploration program must be approved by the Mining Supervisor. Upon the grant of the approvals referred to in this section, a core-drilling permit will be issued to the applicant.

4. The applicant is hereby notified that, if a permit is issued, he shall be required to file with the Mining Supervisor a detailed drilling plan, which must be approved prior to the commencement of operations on the lands covered by the special land use permit. The detailed drilling plan shall include location of holes, drilling method, size of hole, size of core, length and size of casing, safety precautions, abandonment procedures, and a schedule of the projected time period during which the work is to be performed, including starting and completion dates.

5. A permittee shall be required to: (1) commence drilling operations within one year from the date of approval of a detailed drilling plan for the permit; (2) conduct his operation in such a manner as not to interfere with or endanger operations on any existing or future mineral lease, nor interfere with or endanger other land uses; (3) conduct his operations in such a manner as to preserve and protect the environment, including land, water and air, and to protect and conserve other natural resources; (4) comply with all applicable Federal, State, and local regulations or requirements pertaining to these operations, including the regulations in 43 CFR Part 23 and 30 CFR 231; (5) post a $5,000 bond with the Department for each special land use permit issued to cover damages that may be caused to the environment or resources, either on-site or off-site, by construction, maintenance, and use of roads or trails, or by other activities conducted under the permit; and (6) post a $5,000 bond with the Department for each informational core hole to be drilled, to assure compliance with regulations for drilling and abandonment operations (30 CFR 231 and 43 CFR Part 23).

6. All data obtained by a permittee shall be shared with the Department of the Interior, at no cost to the Federal Government. Resource data, but not environmental data, which is made available to the Department by the permittee, shall be treated as confidential proprietary information for not more than five years or until the permit lands are leased for oil shale, whichever is sooner.

7. The recipient of a special land use permit or a participant shall acquire no right to a lease or to preferential treatment, nor shall equities of any kind be deemed to accrue, as a result of exploration conducted under an informational core drilling permit. Permittees and participants shall be required to stipulate that data acquired from such informational drilling shall not be relied upon to support an application for patent or lease, nor be submitted as evidence in any administrative contest or court proceeding concerning the validity of mining claims or the validity of sodium preference-right lease applications on oil shale lands.

8. Detailed requirements and stipulations pertaining to operations and environmental protection shall be incorporated in any permit that may be issued by the Department. For further information concerning such requirements and stipulations, interested parties are referred to the Program Statement for the Proposed Prototype Oil Shale Leasing Program, published by the U. S. Department of the Interior, Washington, D. C., June 1971.

APPENDIX B

PROPOSED OIL SHALE LEASE

The proposed lease form has been prepared for dissemination at this time in order to provide as much time as possible for review by all interested parties of the lease provisions developed to reflect the goals and scope of the Prototype Oil Shale Leasing Program. Though it is expected that the final lease form adopted for this program will be along the same general lines as this draft lease, it should be understood that any provision is subject to clarification and change.

Definitions, formulas, and other clarifying matter will be included in proposed leasing regulations now under study, which will, when promulgated, become 43 CFR Part 3170. For informational purposes, the following specific comments on the lease form are offered:

A. Sec. 1. The bracketed provisions of paragraph (2) of subsection 1(a) are included to indicate that, in appropriate cases, the lease may provide for surface use of lands in addition to those lands containing the leased deposits where such use of additional lands is necessary for a successful operation.

B. Sec.1(a)(1) and Sec. 2(c). Definitions of oil shale and its products as used in the proposed lease form will be incorporated in the leasing regulations now being formulated.

If, upon Departmental evaluation of lands to be offered for oil shale leasing, it appears that valuable deposits of sodium mineral compounds or other minerals occur in such lands intermixed and intermingled with deposits of oil shale, it is intended that all of such minerals, if otherwise available, will be offered for lease together with the oil shale in a combined package lease offering.

A lessee would be required to pay a royalty on such sodium mineral compounds or other minerals of 3 percent of the quantity or gross value of the output thereof at the point of shipment to market for the first ten years of a lease;

4 percent beginning the eleventh year and for each succeeding year to and including the fifteenth year; and thereafter 5 percent beginning the sixteenth year and for the remainder of the lease term.

C. Sec. 2(c)(iv). Provision is made herein for the allowance of a royalty credit for extraordinary environmental costs incurred by the lessee in complying with the stringent environmental safeguards and reclamation requirements of the regulations in 43 CFR Part 23 and Sec. 5 of the lease. It provides that where a lessee shows to the satisfaction of the Secretary that he has sustained extraordinary costs, the Secretary may, in order to offset such costs, adjust the royalties that would otherwise become due and payable thereafter by allowing a credit against those royalties in such amount, and for such time, as he determines are warranted in the circumstances. Inasmuch as the bond required under subsection 5(e) of the lease must be in that amount determined to be necessary to meet all requirements of the applicable regulations and Sec. 5 of the lease, as the same relate to environmental protection and reclamation requirements, costs in excess of such amount may be considered extraordinary and unanticipated costs. A ceiling, therefore, has been placed upon the amount of costs that may be considered to be extraordinary costs.

The lessee must make a showing that the costs are attributed to environmental protection and reclamation requirements. In determining the amount of the credit that should be allowed in any given case, the Secretary will assess the impact of such costs on lease operations and the effect such costs may have on continued development and production under a lease.

The royalty credit provision is designed to achieve the maximum possible environmental integrity while allowing an oil shale industry to achieve commercial stature and thereby bring oil from oil shale into the nation's energy supply. The provision has been devised specifically and only for inclusion in the six prototype leases provided for in the planning program and only as an effort to promote the development of a presently nonexisting industry. There is no intention to include such a provision in any later oil shale leasing efforts, nor in leases covering other minerals which are utilized in established industries.

D. Sec. 2(d). The figures in brackets are included as an example of minimum production requirements. The minimum production rate will vary in accordance with the estimated amount of recoverable reserves established before sale in a ratio proportional to the amounts used in the example.

E. Sec. 5. The material in brackets in paragraph (a) is included as an explanation of the environmental and reclamation requirements to be formulated after technical examination of the particular lands to be leased. Such requirements will be incorporated in the lease, as required by the regulations. In this connection, see section 10 of the proposed lease.

F. It is anticipated that there will be an amendment of the regulations in 43 CFR Part 23. Development plans, such as provided for in subsection 2(s) of the proposed lease, would be included in the coverage of Part 23. At such time as an amendment is made, Sec. 5 of the lease form, and any other section requiring change, will be revised to reflect such amendment.

An amendment to Part 23 is under consideration to include, among other things, requirements for development plans to the effect that--

(1) Any development plan shall include, but not be limited to, a detailed projected analysis of: (i) the amount and types of expected waste materials; (ii) the location and extent of residue disposal areas; (iii) the types of vegetation to be used in land restoration; (iv) a time schedule for restoring the lands; and (v) a showing to the satisfaction of the Department that the disposal and restoration system has been designed so as to protect the long-term biotic productivity of the affected area; and

(2) Operations conducted by the lessee under the development plan shall be subject to continuous monitoring by the regional mining supervisor, or such other officials as may be designated by the Department, and all physical facilities and records pertaining to such operations may be inspected by said officials.

G. In further reference to environmental considerations, the Department intends to formulate specific environmental criteria, controls, and constraints for incorporation in any oil shale lease issued under the proposed program which will be based upon such additional information and data as may be derived from core drilling programs, further Departmental field studies or other sources. The purpose of those provisions will be to provide more assurance that controllable adverse environmental effects will be, in fact, controlled.

Form 3170-1
(June 1971)

Land Office Serial Number

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

OIL SHALE LEASE

In consideration of the benefits conferred on each party by the terms of this contract, this lease is entered into on , by the United States of America, hereinafter called the lessor, acting through the Bureau of Land Management of the Department of the Interior, hereinafter called the Department, and

,hereinafter called the lessee, pursuant and subject to the terms and provisions of the Mineral Leasing Act of February 25, 1920, (41 Stat. 437), as amended (30 U.S.C. §§ 181-263) (hereinafter referred to as "the Act"), and to the terms, conditions, and requirements (1) of all reasonable regulations promulgated by the Secretary of the Interior thereunder in existence upon the effective date of this lease, specifically including but not limited to the regulations in 43 CFR Parts 3100, 3170 and 23 and 30 CFR Part 231, all of which are incorporated herein and, by reference, made a part hereof; and (2) of all reasonable regulations hereafter promulgated thereunder, when not inconsistent with any express and specific provisions of this lease, all of which shall be, upon promulgation, incorporated herein and, by reference, made a part hereof.

WITNESSETH:

Sec. 1. The lessor, does hereby grant and lease to the lessee:

(a) Rights of lessee. (1) The exclusive right and privilege to mine, retort, process by in situ methods, and dispose of all the oil shale and its products, hereinafter referred to as the leased deposits, in, upon, or under the following-described tracts of land, situated in the County of ,
State of :
containing acres, more or less, together with the right, subject to the applicable regulations and the requirements imposed thereunder, to construct all such works, buildings, plants, structures, and applicances as may be necessary or convenient for the mining, retorting, processing, and preparation of the leased deposits for market and the housing and welfare of employees, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

[(2) In addition to the rights and privileges granted under Paragraph (a) of this Sec. 1, and subject to the same conditions and requirements, the right and privilege to use the surface of the following-described tracts of land for the extraction and reduction of the leased deposits, situated in the County of , State of:
containing acres, more or less.]

(b) Lease term. This lease shall be for a period of 20 years and so long thereafter as there is production from the leased deposits in paying quantities, subject to the right of the lessor to readjust the terms and conditions of this lease at the end of each 20-year period as provided in Sec. 3(d) hereof.

Sec. 2. The lessee hereby agrees:

(a) Bond. To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all of the provisions of the lease, except those provisions compliance with which is made subject to the bonds required under subsections 2(r) and 5(e) hereof, and to increase the amount of, or to furnish such other, bond as may be required.

(b) Rental. To pay lessor, annually, in advance, for each acre or fraction thereof covered by this lease, beginning with the date hereof, 50 cents for each calendar year, such rental for any calendar year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(c) Royalty. (1) Oil Shale extracted by mining methods. (i) Except as otherwise provided in this subsection 2(c), to pay the lessor a royalty of 12 cents on every ton of 2,000 pounds of oil shale containing 30 gallons of shale oil per ton mined for processing under this lease.

(ii) The royalty shall increase or decrease 1 cent, or fraction thereof, on every ton of oil shale mined for each gallon, or fraction thereof, of increase or decrease in shale oil content above or below 30 gallons per ton of oil shale.

(iii) The royalty shall likewise increase or decrease in the same percentage as the percentage of increase or decrease in the combined average value per barrel of all crude oil and crude shale oil produced in the States of Colorado, Utah, and Wyoming as of January 1 of each year, as determined by the Secretary of the Interior, the said average value to be in effect during the entire year beginning on that date. For the purpose of this computation, the initial combined average value shall be the value determined for the year in which actual production commences or for the eleventh year of this lease, whichever is earlier.

(iv) In no event, however, shall the royalty be decreased in the manner prescribed in the 2nd or 3rd paragraphs of this subsection to become less than 4 cents on every ton of oil shale mined under the lease.

(v) The shale oil content of the oil shale shall be determined by the Modified Fischer Assay method and the royalty shall be based on the weighted monthly average of shale oil content of every ton of oil shale mined under this lease. Computations of quantities, assays and royalties shall be rounded to the nearest hundredth.

(2) Oil Shale processed by in situ methods. (i) Except as otherwise provided in this subsection 2(c), to pay the lessor a royalty of 12 cents on every ton of 2,000 pounds of oil shale which is processed by in situ methods for recovery of shale oil or other combustible products, which oil shale shall be deemed for the purposes hereof to contain 30 gallons of shale oil per ton. The number of tons of oil shale shall be determined by: (1) establishing through calorimetric tests designated by the American Society for Testing and Materials as "Standard" or "Tentative," the total gross heat of combustion in Btu's of all oil and gas products at the well head, adjusted downward by the total gross heat of combustion in Btu's of combustible fluids (gases or liquids) injected as heat carriers, but not for fuel purposes, into the formation being processed; (2) dividing the adjusted total gross heat of combustion in Btu's by 152,700 Btu's (the typical total gross heat of combustion of oil plus gas demonstrated to be present per gallon of shale oil recovered by modified Fischer assay of oil shales containing approximately 30 gallons of shale oil per ton), to arrive at the equivalent number of gallons of shale oil produced; and (3) dividing the equivalent number of gallons of shale oil produced by 30, to arrive at the number of tons of oil shale processed by in situ methods.

(ii) The royalty shall increase or decrease in the same percentage as the percentage of increase or decrease in the combined average value per barrel of all crude oil and crude shale oil produced in the States of Colorado, Utah, and Wyoming as of January 1 of each year, as determined by the Secretary of the Interior, the said average value to be in effect during the entire year beginning on that date. For the purpose of this computation, the initial combined average value shall be the value determined for the year in which actual production commences or for the eleventh year of this lease, whichever is earlier.

(iii) Computations of quantities, assays and royalties relating to tonnage of oil shale shall be rounded to the nearest hundredth.

(3) General. (i) Royalties on the leased deposits shall be payable monthly in cash or delivered in kind at the option of the lessor.

(ii) When paid in value such royalty on production shall be due and payable monthly on the last day of the calendar month following the calendar month in which produced.

(iii) When royalty is to be taken in kind the lessee shall be notified 3 months in advance that delivery of royalty products shall be required for a stated period not exceeding 12 months. Royalty products shall be delivered in merchantable condition at the point of shipment without cost to the lessor at such time and in such storage facilities provided by the lessee as may reasonably be required by the lessor, provided, that the lessee shall not be required to hold the royalty products in storage for more than 30 days beyond the end of the month in which produced, and provided further, that the lessee shall in no manner be responsible or held liable for the loss or destruction of the royalty products in storage from causes over which the lessee has no control.

(iv) Upon a showing to the satisfaction of the Secretary that compliance with the requirements prescribed in any exploration or mining plan, or amended, supplemental, or partial plan, approved in accordance with the regulations in 43 CFR Part 23, now or hereafter in force, and the requirements of Sec. 5 hereof, has engendered or will engender extraordinary costs (1) not within the contemplation of the parties on the effective date of such plan, and (2) in excess of the amount of any outstanding bond filed and maintained by the lessee pursuant to subsection 5(e) hereof, the Secretary may, in order to offset such costs, adjust the royalties that would otherwise become due and payable thereafter under subsections 2(c) or 2(d) by allowing a credit against those royalties in such amount, and for such time, as he determines are warranted in the circumstances.

(v) It is expressly understood that, notwithstanding any other provision hereof, the lessor reserves the right to readjust the royalties prescribed in this subsection 2(c) as provided for in subsection 3(d) hereof.

(d) Minimum production. (1) Beginning with the sixth calendar year of the lease, except when the Secretary has directed or consented to a suspension of operations under Sec. 39 of the Act, to mine, or process by in situ methods, the leased deposits during that year to a royalty value of $1 per acre or fraction thereof, and thereafter the royalty value shall increase $1 per acre per year each succeeding year to and including the tenth year to a royalty value of $5 per acre or fraction thereof.

(2) Or beginning the sixth calendar year, in lieu of any mining or in situ processing to pay minimum royalty of $1 per acre or fraction thereof, and thereafter the minimum royalty shall increase $1 per acre per year each succeeding year to and including the tenth year to a minimum royalty of $5 per acre or fraction thereof.

(3) Beginning with the eleventh calendar year of the lease, except when the Secretary has directed or consented to a suspension of operations under Sec. 39 of the Act, to mine, or process by in situ methods, the leased deposits during that year at a minimum production rate of the equivalent of [3,500] tons of 2,000 pounds of oil shale containing 30 gallons of shale oil per ton per day, which is hereby established on the basis of an estimated recoverable reserve within the leased lands on the effective date of this lease of [2,100,000,000] tons of oil shale containing an average 30 gallons of shale oil per ton, and pay royalty thereon as prescribed in subsection 2(c) hereof, and thereafter the minimum production rate shall increase in a like amount of [3,500] tons of oil shale per day per year each succeeding year to and including the twentieth year to a rate of [35,000] tons of oil shale per day, and the royalty payable during such succeeding years as prescribed in subsection 2(c) shall likewise increase in relation to the increase in the minimum production rate.

(4) Or beginning the eleventh calendar year, in lieu of any mining or in situ processing to pay minimum royalty of a value equivalent to the royalty value on a production rate of [3,500] tons of oil shale containing 30 gallons of shale oil per ton mined per day as prescribed in subsection 2(c) hereof, and thereafter the production rate for computing the minimum royalty shall increase in a like amount of [3,500] tons of oil shale per day per year each succeeding year to and including the twentieth year to

a production rate of [35,000] tons of oil shale per day, and the minimum royalty payable during such succeeding years shall likewise increase in relation to the increase in the production rate and in the equivalent royalty payable thereon as prescribed in subsection 2 (c).

(e) Payments. To make rental and bonus payments to the Manager of the appropriate Land Office, except that when this lease becomes productive the rentals, bonus installments, if any, and royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) Plats, reports, maps. (1) At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined or processed by in situ methods during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with regulations in 30 CFR Part 231.

(2) To prepare and furnish at such times and in such form as the lessor may prescribe, maps, photographs, reports, statements and other documents in accordance with the regulations in 43 CFR Part 23.

(g) Weights. To determine accurately the weight or quantity and quality of all leased deposits mined or processed by in situ methods and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) Inspection and investigation. To permit at all reasonable times by any duly authorized officer of the Department: (1) inspection or investigation of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) copying and making extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) Assignment. To file for approval in the appropriate Land Office, within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument shall take effect on the first day of the month following approval by the Bureau of Land Management, or, if the assignee requests, on the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

(j) Equal Opportunity Clause; certification of non-segregated facilities.

(1) Equal Opportunity Clause. During the performance of this contract the lessee agrees as follows: (i) The lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the lessor setting forth the provisions of this Equal Opportunity clause.

(ii) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(iii) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the lessor, advising the labor union or workers' representative of the lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(iv) The lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations and relevant orders of the Secretary of Labor.

(v) The lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(vi) In the event of the lessee's noncompliance with the Equal Opportunity clause of this lease or with any of the said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(vii) The lessee will include the provisions of Paragraphs (i) through (vii) of this subsection 2(j) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor or vendor. The lessee will take such action with respect to any contract, subcontract or purchase order as the Secretary may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event the lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor or vendor as a result of such direction by the Secretary, the lessee may request the lessor to enter into such litigation to protect the interests of the lessor.

(2) Certification of nonsegregated facilities. By entering into this lease, the lessee certifies that lessee does not and will not maintain or provide for lessee's employees any segregated facilities at any of lessee's establishments, and that lessee does not and will not permit lessee's employees to perform their services at any location, under lessee's control, where segregated facilities are maintained. The lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause in this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. Lessee further agrees that (except where lessee has obtained identical certifications from proposed contractors and subcontractors for specific time periods) lessee will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that lessee will retain such certifications in lessee's files; and that lessee will forward the following notice to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods): Notice to prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract

or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semi-annually, or annually).

(k) Lands disposed of with leased deposits reserved to the United States. If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the leased deposits therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such deposits.

(l) Operations, mining and reclamation of lands, wages, freedom of purchase. To comply with the operating regulations (30 CFR Part 231), to exercise reasonable diligence, skill, and care in the operation of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health, or property, and of waste or damage to any water or mineral deposits; to comply with the surface exploration, mining and reclamation of lands regulations (43 CFR Part 23) to avoid, minimize, or correct damage to the environment, including land, water, and air, and to avoid, minimize, or correct hazards to the public health and safety; to pay all wages due miners and employees both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding 8 hours in any one day for underground workers, except in cases of emergency; to employ no boy under the age of 16 and no girl or woman, without regard to age, in any mine below the surface, unless the laws of the State otherwise provide, in which case the State laws control.

(m) Taxes. To pay, when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) Overriding royalties. Not to create, by assignment or otherwise, an overriding royalty interest in excess of 25 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Department that he has made substantial investments for improvements on the land covered by the assignment.

(o) Delivery of premises in case of forfeiture. In case of forfeiture of this lease to deliver up to the lessor in good order and condition, in accordance with the applicable regulations, and subject to the provisions of Sec. 6 hereof, the land leased, including permanent improvements and other property, whether fixtures or personalty, and all underground timbering, well casing, and such other supports and structures as are necessary for the preservation of any mines, other underground development works, or deposits.

(p) Extraction by in situ methods or by solution. Where the minerals are taken from the earth by in situ methods or in solution, with the express consent of the lessor which must be first obtained, the location within a producing formation of an entry, well, or opening for extraction shall not be within 500 feet of the boundary line of leased lands without the permission of or unless directed by the lessor, nor shall induced fracturing extend to less than 100 feet from that boundary line.

(q) Nuclear stimulation. Not to utilize nuclear-explosive fracturing or stimulation in the extraction or processing of minerals subject to this lease, without the express, written consent of the Secretary of the Interior being first obtained.

(r) Bonus. (1) Except as provided in Paragraph (2) hereof, in addition to the payment made at the time of sale of this lease in the amount of /   / dollars, being the first installment on the bonus bid for the sale of this lease, to pay the lessor the amount of /   / dollars due and owing on the bonus bid in 4 equal annual installments of /   / dollars, such payments to be made on the first anniversary date of this lease and thereafter on each succeeding anniversary date to and including the fourth anniversary date.

(2) In the event the Secretary of the Interior should accept the surrender or relinquishment of this lease at any time prior to the third anniversary date of the lease, the lessee shall be released from the obligation to pay the fourth and fifth installments of the bonus which would have been otherwise due and owing on the third and fourth anniversary dates, respectively, of this lease.

(3) To maintain, in addition to the bonds maintained under subsections 2(a) and 5(e) hereof, the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with the terms and conditions of this subsection 2(r) for the payment of the balance of the bonus due and owing to the lessor.

(s) Development Programs; diligence requirements. (1) Upon issuance of this lease, and in accordance with the approved preliminary development program incorporated in the terms of the offer, to proceed to diligently develop and to mine the leased deposits by approved methods and in such manner as to utilize all of the leased deposits that can be successfully processed hereunder.

(2) (i) To file with the mining supervisor on or before the third anniversary hereof a detailed development program, including a schedule of the planning, exploratory, development and production operations to be conducted thereunder, and a detailed description of the procedures to be followed to assure that the development program,

and lease operations thereunder, will meet and conform to the specific environmental criteria, controls, and constraints incorporated in the lease, which have been formulated by the lessor for the express purpose of preserving and protecting the environment, including land, water, air, and other natural resources within the area in which the leased premises are situated; and (ii) prior to commencing any of the said operations on or in the leased premises, to obtain approval of the detailed development program in accordance with the applicable regulations, and to proceed to diligently develop and to mine the leased deposits by approved methods and in such manner as to utilize all of the leased deposits that can be successfully processed hereunder.

(3) To file with the mining supervisor annual progress reports describing the operations actually conducted under the development program prescribed in Paragraph (2) above.

(4) To submit for approval in accordance with the applicable regulations a written statement of any proposed change in or supplement to the development plan prescribed in Paragraph (2) above, including any request for delay in scheduled performance, and the justification for the changes proposed. Any change or supplemental plan shall become effective only upon approval.

Sec. 3. The lessor expressly reserves the following rights, powers and authority:

(a) Easements and rights-of-way; investigations. (1) Upon such terms as it may determine to be just, the right to permit for joint or several use such easements or rights-of-way, including easements in tunnels, upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the Act, and the treatment and shipment of the products thereof by or under authority of the Government, its lesses or permittees, and for other public purposes.

(2) The right to conduct geological and other investigations which do not interfere with or endanger operations under this lease.

(b) Disposition of surface. The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the leased deposits therein, or to dispose of any surface resource in such lands which will not unreasonably interfere with operations under this lease.

(c) Monopoly and fair prices. The full power and authority to promulgate and enforce all orders and regulations issued under the provisions of Sections 30 and 32 of the Act, as amended, necessary to insure the sale of the production of the leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) Readjustment of terms and conditions. The right reasonably to readjust royalties payable hereunder and other terms and conditions at the end of the first 20-year period specified in Sec. 1 hereof, and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such readjusted terms and conditions.

(e) Waiver of conditions. The right to waive any breach of the conditions contained herein, except such conditions as are required by the Act, as amended, but any such waiver shall extend only to the particular breach as waived and shall not limit the rights of the lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. Relinquishment of lease. (a)Upon a satisfactory showing: (1) of compliance with the applicable regulations, and (2) that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. In no event shall the public interest be deemed to be impaired by a surrender or relinquishment of this lease prior to the third anniversary date hereof.

(b)A relinquishment must be filed, in duplicate, in the proper Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety, in accordance with the applicable regulations and the terms and conditions of this lease: (1) except as provided in subsection 2(r)(2) hereof, to make payment of all accrued bonus payments, rentals, and royalties; (2) to provide for the preservation of any mines, in situ productive works, underground development works, other permanent improvements or other property, whether fixtures or personalty, on the leased land; (3) to provide for the reclamation of lands and waters affected by exploration or mining operations under this lease; and (4) to comply with all the requirements of sec. 5 of this lease.

Sec. 5. Protection of the environment, nonmineral resources, and improvements, and reclamation of lands and waters. The lessee agrees:

(a) To meet all requirements formulated in accordance with the regulations in 43 CFR Part 23, for the preservation and protection of the environment, including land, water, and air, for the protection and conservation of nonmineral resources during the conduct of exploration or mining operations, and the reclamation of lands and waters affected by exploration or mining operations.

[There shall be incorporated in and made a part of this lease (see sec. 10) stipulations of the general requirements formulated in accordance with 43 CFR sec. 23.5 by the authorized district manager of the Bureau of Land Management and the authorized regional mining supervisor of the Geological Survey upon the basis of a technical examination of the prospective effects of the proposed exploration, development, or mining operations upon the environment and nonmineral resources, taking into consideration the need for: (1) the preservation and protection of other resources, including recreational, scenic, historic, and ecological values; (2) the control of erosion, flooding, and pollution of water; (3) the isolation of toxic materials; (4) the prevention of air pollution; (5) the reclamation by revegetation, replacement of soil, regrading and backfilling, or by other means, of lands affected by the exploration or mining operations; (6) the reclamation of waters affected by the exploration or mining operations; (7) the prevention of slides; (8) the protection of fish and wildlife and their habitat; and (9) the prevention of hazards to public health and safety, as, and to the extent that each of these factors is or may be affected by local conditions of topography, climate, surrounding land uses, proximity to densely used areas, and other environmental influences.]

(b) In addition to meeting the requirements specified in paragraph (a) hereof, to conduct exploration or mining operations in compliance with all applicable Federal, State, and local water pollution control, water quality, air pollution control, and air quality standards.

(c) To comply with any exploration or mining plan, or amended, supplemental, or partial plan, approved in accordance with the regulations in 43 CFR Part 23, the requirements of paragraph (b) hereof, and other terms and conditions of this lease, and to take such steps as may be specified in any such plan for the preservation and protection of the environment, the protection and conservation of nonmineral resources during the conduct of exploration or mining operations, and the reclamation of lands and waters affected by exploration or mining operations.

(d) To comply with the requirements for cessation or abandonment of operations under any exploration or mining plan, or amended, supplemental, or partial plan, approved in accordance with the regulations in 43 CFR Part 23, the requirements of paragraph (b) hereof, and other terms and conditions of this lease, and to carry out and complete operations, including all reclamation requirements, in accordance with any such plan.

(e) (1) Upon approval of an exploration plan or mining plan, to file with the lessor and maintain, in addition to the bonds required under subsections 2(a) and 2(r) hereof, a bond in an amount of not less than $500 per acre of land estimated to be affected during the first 3-year period of exploration or mining operations, and thereafter during each succeeding 3-year period of exploration or mining operations, or in such amount as may be established at the time of approval of any exploration or mining plan, including amended, supplemental, or partial plans, whichever is greater, but in any event in an amount of not less than $2,000, which bond shall be conditioned upon the faithful compliance with the regulations in 43 CFR Part 23, particularly Sec. 23.9, the terms and conditions of the Sec. 5, and any approved exploration or mining plan, or approved amended, supplemental, or partial plan, as the same relate to the preservation and protection of the environment, including land, water, and air, the protection and conservation of nonmineral resources during the conduct of exploration or mining operations, and the reclamation of lands and waters affected by exploration or mining operations.

(2) The amount of the bond may be increased or decreased upon approval of an amended, supplemental, or partial mining plan which includes an increase or decrease in the estimated number of acres to be affected during the period of exploration or mining operations covered by the plan, but in no event shall the amount become less than $500 per acre of land estimated to be affected, nor less than $2,000 in total amount, during the period of operations covered by the plan. The bond may be released as to leased lands affected by exploration or mining operations during the period covered by an approved exploration or mining plan, or approved amended, supplemental, or partial plan, at such time as, and to the extent that it is determined by the lessor that such lands meet the reclamation requirements of the approved exploration or mining plan and that operations have been carried out and completed with respect to these lands in accordance with the approved plan.

(f) To take such reasonable steps and to conduct operations in such manner as may be needed to prevent operations from unnecessarily: (1) damaging any forage and timber growth on the leased lands, or on Federal or non-Federal lands in the vicinity; (2) damaging crops, including forage, timber, or improvements of a surface owner; or (3) damaging improvements whether owned by the United States or by its permittees or lessees. The lessor may prescribe the steps to be taken and the restoration to be made with respect to the leased lands and improvements thereon, whether or not owned by the United States, in the event of the occurrence of damage described in this paragraph (f).

Sec. 6. Removal of property on termination of lease. (a) Upon termination of this lease, by surrender or forfeiture, the lessor, his agent, licensee, or other lessee, shall have the exclusive right, at the lessor's election, to purchase at any time within 6 months thereafter, at the appraised value thereof, any or all structures, equipment, machinery, tools, appliances, and materials, whether fixtures or personalty, placed by the lessee in or on the land leased hereunder, other than all underground timbering and such other supports and structures as are necessary for the preservation of any mines or other underground development works, which shall be and remain a part of the realty without further consideration or compensation; the purchase price to be paid for such structures, equipment, machinery, tools, appliances, and materials shall be fixed by appraisal of three disinterested and competent persons (one to be designated by each party thereto and the third by the two so designated), and the valuation of the three or a majority of them shall be conclusive; pending such election to purchase within said period of 6 months, none of those structures or other property shall be moved from its normal position.

(b) At any time within a period of 90 days after election by the lessor not to purchase or upon expiration of said period of 6 months without election by the lessor, the lessee shall have the privilege of removing from the premises said structures and other property except said timbering and other supports and structures as are necessary for the preservation of any mines or other underground development works as aforesaid.

(c) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the lessee as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions or other good and sufficient reason, at the election of the lessor, but the lessee shall remove any or all of such property on expiration of said 90-day period when so directed by the lessor.

Sec. 7. Remedies in case of default. If the lessee shall not comply with any of the provisions of the Act or the regulations thereunder or make default in the performance or observance of any of the provisions of this lease and such default shall continue for a period of 30 days, or such other period as may be specified under applicable regulations, after service of written notice thereof by the lessor, the lessor may suspend operations where authorized by the applicable regulations until such time as any required action is taken to correct noncompliance, or the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in Sec. 31 of the Mineral Leasing Act, and for forfeiture of any performance bond required by the applicable regulations. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. The lessee shall not, however, be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. Heirs and successors in interest. Each obligation hereunder shall extend to and be binding upon, and every benefit shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. Unlawful interest. No member of, or Delegate to, Congress, or Resident Commissioner, after his election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes of the United States, (41 U.S.C. § 22), as amended, and Sections 431, 432, and 433, Title 18 of the United States Code, relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

Sec. 10. There are attached hereto and specifically incorporated in and made a part of this lease stipulations of the general requirements formulated pursuant to the regulations in 43 CFR Part 23, particularly sec. 23.5, which have been made known in writing to and accepted by the the undersigned lessee and which the said lessee must meet for the protection of nonmineral resources during the conduct of exploration or mining operations and for the reclamation of lands or waters affected by exploration or mining operations.

THE UNITED STATES OF AMERICA

BY____________________________
(Authorized Officer)

____
(Title)

Witnesses to Signature of Lessee(s)

____
(Date)

____________________________ ____________________________
(Signature of Lessee)

____________________________ ____________________________
(Signature of Lessee)

____________________________ ____________________________
(Signature of Lessee)

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